FOUNDRY TRADE JOURNAL

EST. 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 102
No. 2101
Registered at the G.P.O. as a Newspaper

JANUARY 17, 1957
Offices: John Adam House, John Adam St., London, W.C.2

Single Copy, 9d. By Post 1/-. Annual Subscription, Home 40/-, Abroad 45/- (Prepaid)

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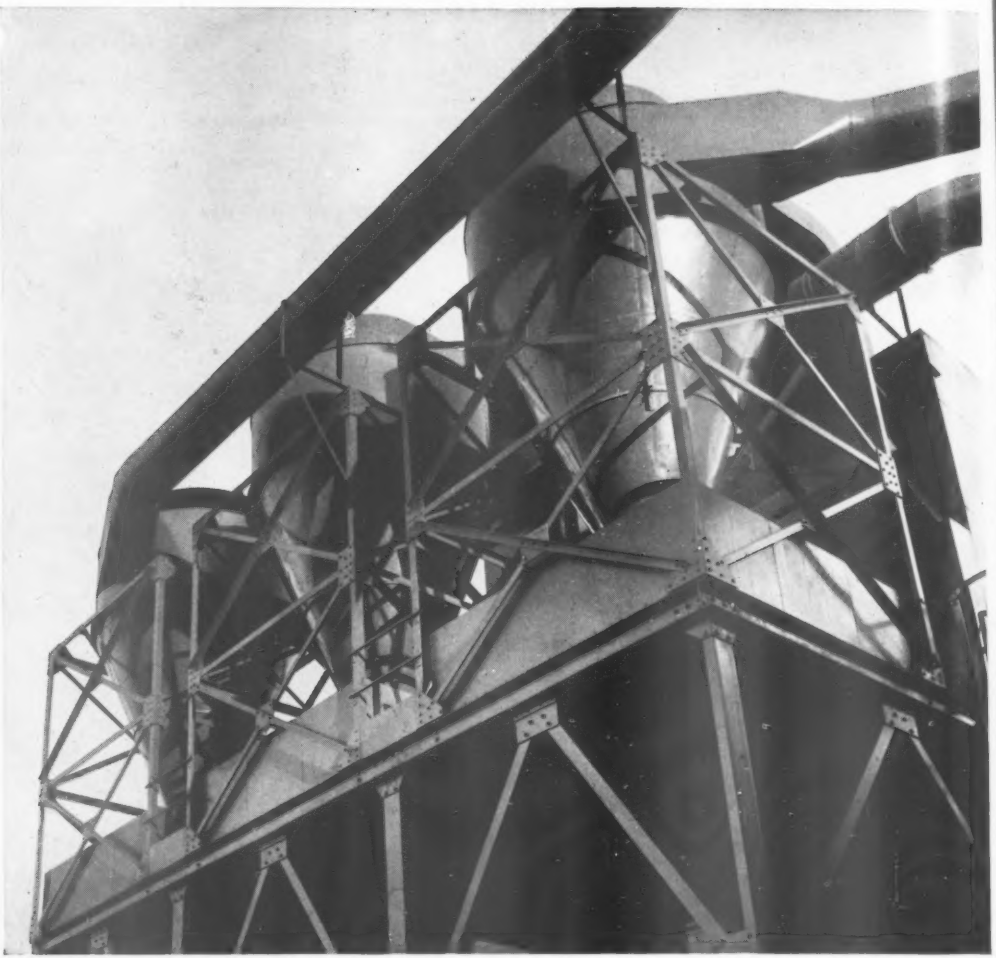

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FOUNDRY TRADE JOURNAL

Established 1902

Vol. 102 Thursday, January 17, 1957 No. 2101

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AN INDUSTRIAL NEWSPAPERS PUBLICATION

Published Weekly

Single copy 9d.; by post 1s.

Annual subscription: home 40s., abroad 45s. (prepaid).

17/19 JOHN ADAM STREET, ADELPHI, LONDON, W.C.2

'Phone: TRAfalgar 6171 (10 lines).

'Grams: Zacatecas, Rand. London.

How to Run a Monopoly

It will take some time before trade associations know just how they stand *vis à vis* the Monopolies and Restrictive Practices (Inquiry and Control) Act 1948; because with the publication of each of the reports of the Monopolies and Restrictive Practices Commission, new facets are brought to light. Unfortunately, the theoretical impact on the public of the Commission's findings often receives emphasis, to the exclusion of the ultimate practical significance. If the public were being exploited in their daily, weekly, or monthly purchases, there would be obviously—and rightly—much indignation.

A recent report of the Commission, on Standard Metal Windows and Doors,* is of real interest to trade associations. It refers to a case where there is an alternative material—wood—the price for which can be, and obviously is, competitive. Such conditions are, in fact, quite usual. To our mind, the Metal Window Association has conducted its affairs very sensibly ; selling prices were formulated on receipt of actual manufacturing costs of the various members and a lower than the average was selected as a basis. This resulted in the most efficient firms making the highest profit and provided a target for those not so well operated. Quoting from the Report: "Under the system as now operated, both the costs of individual manufacturers and the difference between one manufacturer's and another's are being reduced, and prices tend to be based on the lower costs calculated at a reasonable level of activity and with the addition of profits which, on average, are reasonable." . . . "While the whole of the MWA's case is not accepted, the Commission considered that the system has certain merits, such as exposing the less-efficient manufacturer to some of the pressure which he would experience under full-price competition."

It might be as well to consider what often happens with unrestricted competition. In the case of metal windows, for example, prices would be cut, and the limited public buying windows might temporarily benefit, but if such procedure resulted—as it not infrequently does—in a bankruptcy, then another limited number of people might suffer very severely. This, we suggest, is not in the public interest, or yet in the interest of securing optimum working conditions and wage levels within an industry. The Commission, when dealing with the MWA, criticized the practice of setting uniform "delivered" prices and suggested that "ex-works" prices should be available. Finally, their Report concludes: "Accordingly, no question of action by the Government under the 1948 Act arises in respect of registerable agreements dealt with in this Report." Here, then, is a *modus operandi* which can be emulated without fear by trade associations.

* Published by HM Stationery Office, York House, Kingsway, London, W.C.2, price 5s. 3d. post free.

First Minister of Power

It is of special interest to foundrymen to learn that Sir Percy Mills, BT., K.B.E., whose association with the industry as chairman of W. & T. Avery, Limited, is well known, is to join the new Government under Mr. Harold Macmillan, as his first Minister of Power. This decision by the new Premier to go outside the political field in his choice of a man to direct one of the country's vitally important economic departments, has been referred to as "a bold stroke." Sir Percy has experience of working with the Government, and for the last 12 years has often been called upon to advise Government departments. His appointments included Deputy Director of Ordnance Factories; Controller-General of Machine Tools; and head of the production division of the Ministry of Production. His services were also retained as president of the Economic Sub-Commission for Germany; membership of the advisory council of the Export Credits Guarantee Department; presidency of the Association of British Chambers of Commerce; chairmanship of the National Research Development Corporation; and adviser to H.M. Government on the housing programme. Resulting from his appointment, Sir Percy has relinquished his many industrial executive positions, among these the chairmanship of W. & T. Avery, Limited, and Lancashire Dynamo Holdings, Limited.

The Queen has approved that the dignity of a barony shall be conferred upon Sir Percy and also that he shall be sworn a member of the Privy Council. The new Minister said that the only warning he had of his appointment was when he was called to see the Prime Minister at Downing Street last Friday.

He felt greatly honoured to have been chosen to work for the country in this way, and to serve under Mr. Macmillan whom he greatly respected and admired. Sir Percy's new Ministry will supersede the Ministry of Fuel and Power, and in addition to taking over its responsibilities, it will govern the speeding up of the production of power from atomic sources, and will be responsible for the oversight of the entire iron and steel industry.

Readers will remember that in the JOURNAL personality feature a few months ago, a full-page portrait of Sir Percy and details of his career were published.

Magnesium-alloy Development

The December 13 edition of the American journal, *Iron Age*, carries a feature article covering a new magnesium alloy, the nominal composition of which is 7.6 per cent. Al; 0.7 per cent. Zn; and a minimum of 0.13 per cent. manganese. It is stated to be reasonably similar to other alloys which have been produced both in Europe and Canada, except perhaps for the higher zinc content. It is claimed that it responds more readily to solution heat-treatment, and that yield strength improves with increasing the Al and Zn contents. The properties vary from 10 to 12 tons per sq. in. in tensile with 6 to 4 per cent. elongation. A final claim is improved welding properties.

Dinner

WORSHIPFUL COMPANY OF FOUNDERS

The Livery dinner of the Worshipful Company of Founders was held on Wednesday of last week at the Mansion House, London, the Master, Major L. E. Cotterell, T.D., presiding. The principal guest was the Rt. Hon. the Lord Mayor of London, Sir Cullam Welsh, O.B.E., M.C. Others at the high table were the Master Cutler, Sir Peter Roberts, BT., M.P.; the Bishop of Chelmsford; the Rt. Rev. S. F. Allison, D.D.; Bishop E. G. Gulin of Finland; Mr. H. J. V. Williams; Mr. G. M. Menzies; Vice-Admiral Sir Frank Mason, K.C.B.; the Rt. Hon. the Earl of Northesk; Brigadier Sir John Smyth, BT., V.C., M.C., M.P.; Mr. Albert L. Parrott; and Mr. A. A. Hughes, the Master Bell Founder of the Whitechapel Foundry. The stewards were Mr. R. B. Templeton and Mr. R. C. Scott. During dinner the guests were entertained by the Aylmer orchestra and afterwards by Miss Irene Carpenter (soprano). The pipers of the 1st Battalion London Irish Rifles headed the procession to the high table. As usual, this brilliant function was organized by Mr. Wilson Wiley, M.A., the Clerk of the Company.

Forty Years Ago

In the January, 1917, issue of the FOUNDRY TRADE JOURNAL, the Editor was optimistic as to the progress of the war; the munitions factories were being built and extended in order to supply not only ourselves but our Allies with essential requirements. This issue carried what must surely have been one of the first contributions to the subject of gases in iron and steel. It was presented by the late Mr. J. E. Fletcher. Another pioneer paper, by Mr. T. Brown, described the making of a 22-ton casting built up entirely of cores. An obituary notice appeared of Sir Hiram Maxim, the inventor of the famous machine gun.

Institute of Metals, Spring meeting

The 1957 Spring Meeting of the Institute of Metals, which is to be held jointly with the *Associazione Italiana de Metallurgia*, the *Society Suisse des Constructeurs de Machines*, and the *Schweiz Verband fur die Materialprufungen der Technik*, will take place in London from Monday to Saturday, April 29 to May 4. As well as a number of social events and works visits, a programme of technical sessions (to be held at Church House, Great Smith Street) has been arranged, commencing on the opening day with the May lecture by Sir Eric Ashby, D.SC., SC.D., on "Education in Science and Technology." Simultaneous technical sessions will be held on the Wednesday including a symposium on "Metallurgical Aspects of the Control of Quality in Non-ferrous Castings," during the morning and afternoon; a session on "Niobium" in the morning and one on "Liquid Metals" in the afternoon. The final social event, the banquet at Grosvenor House, Park Lane, London, W.1. will be held on the Thursday evening.

The Midland section of the Institute of Vitreous Enamellers staged its annual dinner (men only) at the Station Hotel, Dudley, on the evening of January 11. Some 70 members were present to hear the toast of the Institute proposed by Mr. S. W. Vickery, chairman of the recently formed Vitreous Enamel Development Council. Mr. G. H. Legg, chairman of the Midland section, responded on behalf of the Institute and welcomed the guests who were present.

"Compo" and Chamotte Moulding*

By R. Wright

The object of this Paper is to give details of the main characteristics, composition, preparation and mode of application of moulding materials suitable for the production of heavy steel castings. Some details of moulding, painting and drying techniques are given: it is considered that the proper application of these is just as important as the composition of the materials involved. Reference is also made to differences between compo moulding and the American practice of using bonded silica sands for producing heavy castings, and to the problems arising from thermal shock when molten steel is filling the mould cavity. European methods of chamotte moulding are also briefly described. This Paper probably represents one of the frankest disclosures ever to be made on the composition of steelfounders' moulding materials, hitherto a jealously guarded trade secret.

MR. WRIGHT, who joined English Steel Corporation in 1936 in the chemical laboratory, has for the past five years been sand technician with English Steel Castings Corporation, Limited. He studied sand preparation and techniques in USA foundries, and has been an active technical committee worker. Honorary secretary of the Sheffield Foundry Trades Technical Society for many years, this year he is president of the Society.

Historical

Moulders' composition, often known as "Sheffield Compo," is probably one of the oldest synthetic moulding mixtures to have been used in this country. A similar material was used for ingot heads and this application may have suggested its use in the making of moulds for castings. This mixture consisted of crucible clay pots, used firebricks and ganister, which were crushed down and bonded with fireclay together with some carbonaceous material such as blacking or graphite. When crucible pots became scarce, they were replaced by the more plentiful, used gas-retort bricks which were, in their turn, superseded by scrap high-alumina firebricks.

In order to increase the refractoriness of the compo, an addition was made of a crushed calcined bauxite clay to the main firebrick base. This bauxite clay occurred naturally in Ayrshire and was a similar type of material to that found in Europe which was a calcined refractory clay-grog called "chamotte." Chamotte moulding was used extensively for heavy steel castings in Czechoslovakia and Germany, possibly because there were few naturally-bonded sands available for steelfoundry use. This moulding material consisted of a coarsely ground mixture of chamotte and clay without any addition of firebrick: it is still being used in Europe.

The standard procedure in the Author's foundry is to use good quality scrap firebrick for the main grog base with an addition of Ayrshire calcined chamotte bonded with fireclay. Certain changes are made in the formulation when it is necessary to suit both complex shapes and to produce cores subject to extreme metal penetration.

* Paper presented at the BSCRA conference, October, 1956.

Ingredients of Compo and Mould Coatings

(a) *Grog.*—The term "grog" is applicable to both fireclays after calcination and to crushed scrap firebricks. For this reason reference will be made specifically either to chamotte grog (*i.e.*, calcined fireclay) or to firebrick grog.

(b) *Chamotte Grog.*—The fireclays which occur in the Millstone Grit and Lower Coal Measures of Ayrshire and the Central Valley in Scotland provide the best source of bauxitic clay, having a refractoriness of not less than 1,700 deg. C. and offering high spalling resistance in the fired brick when used for brick making. After calcination at 1,450 deg. C., these fireclays provide the best chamotte grog for steelfoundry moulding compositions in which the grog acts as a non-shrinking aggregate. The chamotte grog has a low apparent porosity (15 to 20 per cent.) which ensures that during crushing it shatters, but does not break down into fines. Stourbridge fireclays contain more ferric oxide (Fe_2O_3) and are, therefore, less refractory than the Scottish types; they also show a tendency to break down to a finer aggregate during crushing.

It is desirable that the chamotte should lack lamination and should have an alumina content of 40 to 44 per cent., and not more than 4½ per cent. iron oxide. The pyrometric cone equivalent of the chamotte should exceed 1,730 deg. C.

(c) *Firebrick Grog.*—This term is applied to scrap firebrick after crushing. There are many types of used firebrick which are suitable for the base aggregate in compo making and these are principally manufactured near to the coal measures in Northumberland and Durham, South Wales, South Yorkshire and Stourbridge.

Only firebricks free from adhering slag and

TABLE I.—*Typical Screen Analysis (per cent. retained on B.S. Sieves) of Compo.*

B.S. Sieve No.	Crushed firebrick +16	Crushed firebrick −16	Crushed Chamotte (coarse). +16	Crushed Chamotte (coarse). −16	Crushed Chamotte (fine)	Derby Fireclay.	Alundum Fines.	Moulding Compo.
7	25.0	—	24.0	—	—	—	—	6.8
8	11.0	—	18.0	—	—	—	—	5.6
10	15.5	—	20.0	—	3.24	10.00	—	10.0
16	21.5	—	22.0	—	6.23	29.00	—	16.0
22	12.0	2.2	8.0	12.6	7.00	—	—	9.6
30	3.8	13.6	3.1	23.6	11.70	28.00	—	6.6
44	2.0	18.0	2.6	17.4	17.80	—	—	5.6
60	1.4	13.6	1.4	12.0	13.83	16.00	—	4.0
72	0.8	7.0	0.6	6.0	9.92	—	—	2.0
100	1.2	10.0	0.6	8.0	10.00	—	1.63	2.4
150	1.7	11.0	0.5	8.6	9.40	12.00	7.11	3.4
−150	—	—	—	—	14.60	5.00	—	7.8
200	4.9	24.0	0.8	6.0	—	—	11.39	—
300	—	—	—	2.0	—	—	17.89	A.F.S. clay
−300	—	—	—	3.8	—	—	61.97	20.0

jointing material can be used; silica and siliceous bricks must not be entertained. The alumina content should be as high as possible and the fluxes (iron oxides, alkalies, etc.) as low as possible, the desirable limits of composition being: alumina 34 to 40 per cent.; iron oxides 4 per cent. max.; alkalies 1 per cent. max.; silica 50 to 60 per cent; lime and magnesia 1 per cent. max. Hard fired, dense bricks with an apparent porosity of 20 to 25 per cent. and a cold crushing strength of approximately 4,000 lb. per sq. in. are better than the more porous type. The pyrometric cone equivalent of the bricks should exceed 1,650 deg. C.

(d) *Fireclay.*—Fireclays are composed of kaolinite and variable proportions of finely-divided quartz, secondary mica and, in some cases, pyrites. The type of fireclay used in the mixtures discussed is a rough ground Derby fireclay containing 8 to 9 per cent. of natural moisture.

(e) *Alundum Fines.*—These are fused alumina produced as an air-separated by-product during the manufacture of grinding-wheel grit.

Formulation of compo. Formulations of compo for general use in the foundry are as follow:

		wt. per cent.
(1)	Crushed scrap firebricks	65-70
	Crushed chamotte grog	15-20
	Rough ground Derby fireclay	14
	Foundry blacking	1
	Water	9-10
(2)	Coarse brick	45
	Fine brick	23
	Coarse chamotte	18
	Fireclay	14
	Water	9-10

Properties

The mechanical grading and chemical composition of the ingredients of compo are given in Tables I and II and the room- and elevated-temperature properties of the prepared mixture are as follow:

Permeability No. 120-200

AFS Green strength
(5 rams), lb. per sq. in. 12.0 to 14.0

Wt. of AFS test specimen,
grams 190

Dry compression strength
(2 hr. at 200 deg. C.) lb. per sq. in. 200 to 250

Hot Strength (Dietert Thermo-lab.) lb. per sq. in.
2 min. at 2,500 deg. F. 645
4 min. at 2,500 deg. F. 205
8 min. at 2,500 deg. F. 90.

Thermal Shock
No cracks develop in test-piece on soaking for 2 min. at 2,500 deg. F.

Expansion and Contraction
An AFS test-piece maintains its shape when fired at 1,650 deg. C.

Production of Compo

Basically, the plant required to produce compo consists of: (i) a swing-hammer pulverizer or a perforated pan-bottom mill for crushing bricks and chamotte; (ii) a screening unit to grade the crushed materials; (iii) storage for the crushed materials; (iv) a heavy-duty muller for mixing the compo; and (v) a ball mill for the production of the chamotte paint base. A typical flow diagram is shown in Fig. 1.

Firebricks.—All good quality scrap firebricks are saved and crushed by the swing-hammer pulverizer. The manganese-steel swing hammers revolving at high speed, break the bricks against an anvil, these smaller pieces being forced in turn through manganese-steel gratings, the ribs of which have ¼-in. elongated apertures. The discharge from the pulverizer is passed over a two-deck vibrating screen, the upper and lower screen apertures being equivalent to a No. 5 B.S. screen (3.45 mm.) and to a 16

TABLE II.—*Typical Chemical Composition of Compo (per cent.).*

Material.	SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	TiO_2	Loss on Ignition.
Firebrick	55.55	4.30	36.50	0.36	0.85	1.30	—
Chamotte Grog	48.50	3.70	42.00	0.08	0.36	5.00	0.85
Derby fireclay	56.50	2.30	27.50	0.06	0.80	1.20	9.90
						Sulphur	
Foundry blacking	8.80	0.40	5.40	0.25	0.34	1.27	84.00
Alundum fines	2.30	1.85	92.00	0.40	0.20	3.15	Nil

B.S. screen (1 mm.) respectively. The oversize fraction from the upper screen is returned to the pulverizer.

Chamotte.—The chamotte lumps are treated in a similar way. The fractions formed are again a function of the screen sizes, the grate openings in the pulverizer and the physical properties of the fired material.

Fireclay.—Two hoppers are provided for the fireclays which are purchased in the prepared condition. The first accommodates the natural rough ground fireclay and the second holds the dried fireclay which is later mixed with chamotte fines in a ball mill to produce the base mixture for chamotte paint.

Milling.—A travelling weigh-car connects the main hoppers so that exact weights of brick, chamotte grog and fireclay can be weighed from each hopper for loading into a heavy-duty batch muller of 1-ton capacity. The water is metered in immediately after the mill is charged. This is important as it enables the maximum plasticity to be developed from the clay during the mixing and milling cycle. It has been found necessary to plate the muller troughs with rubber strips to prevent excessive wear from taking place.

The weigh car is also used to proportion the 1 mm. chamotte fines and the dried fireclay for introduction into the rubber-lined ball mill, where it is ground to the required grading for use in the chamotte paint.

Mould Coatings

Chamotte paint.—The mixture contains 87 per cent. by weight of 1 mm. chamotte fines and 13 per cent. by weight of dried fireclay, these two ingredients being ball milled together to the approximate grading shown in Table III. The ball-mill fines are mixed to a slurry with dilute sulphite lye solution (1 part of lye to 12 parts of water). This coating is applied to the compo mould surface after the removal of the pattern; cores being treated similarly.

Alundum paint.—This mould coating is applied as a finishing refractory paint over the chamotte paint before drying commences. The mixture is as follows: 112 lb. Alundum fines; 17 lb. ball clay; 2½ lb. dextrine; and 8 gal. water.

Technique of Moulding

The preparation of the bed for a heavy pit-mould is very important because of the tremendous weight of metal and cores which it has to bear. The pit is usually cleared out to a suitable depth and is then plated up with heavy steel plates, ingot moulds or ingot bases, etc., to provide a solid foundation for the bed. A layer of backing sand is rammed on tightly, followed by 4-in. of rammed compo around the area to be occupied by the pattern. After the pattern is placed on the prepared bed, compo is rammed tightly to a depth of 3 to 4 in. from the pattern face and the rest of the pit cavity is filled with weak backing sand of low moisture-content. When the void to be filled by backing sand is too great, ingot moulds or other solid blocks are used both to reinforce the backing and to help to prevent movement of the mould face under the pressure of the liquid steel. Where large vertical sides are encountered, it is usual to ram in tie rods to strengthen the mould and to provide the means of fastening back awkwardly shaped cores. The mould is rammed up to a predetermined joint line.

The copes consist of bolted box parts which are supported all round on a row of firebricks which are to provide a stepped joint between the final top part and the bottom mould. Bricks are laid on the pattern and these support cut lengths of rail from which lifters are hung in a criss-cross pattern between the rails to provide support for the underslung joint face. A compo facing is then rammed in between these lifters and around the heads which are positioned on the top of the pattern at predetermined positions. The rails are so made that the hook bolts can be placed beneath them and subsequently bolted up through assemblies of twin rail which are supported on the top sides of the box. The backing sand is then rammed to the top of the box and the hook bolts made secure before

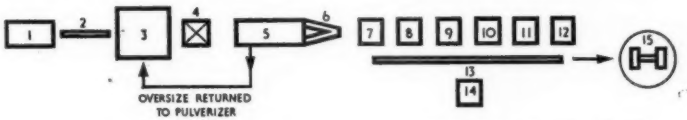


FIG. 1.—*Flow diagram for the production of compo.*

KEY.
1. Rail wagons containing brick or chamotte.
2. Slow moving belt conveyor.
3. Swing-hammer pulverizer.
4. Elevator.
5. Two-deck vibrating screen. Oversize returned to pulverizer.
6. Two air-operated chutes to storage hoppers.
7-12. Separate storage hoppers for coarse brick, fine brick, coarse chamotte, fine chamotte, fireclay (natural), fireclay (dry).
13-14. Travelling weigh-car system.
15. Heavy-duty muller.

TABLE III.—*Approximate Screen Analysis of Chamotte Paint Base.*

							Coarse silt.	Fine silt.	Clay grade.
B.S. Sieve No.	30	44	60	72	100	150	<0.1 mm. >0.05 mm.	<0.05 mm. >0.01 mm.	<0.01 mm.
Per cent. remaining ..	—	1.5	7.5	7.5	15.0	17.5	28.0		18.0

FIG. 2.—*Compo being stripped from a casting during easing.*

the top part is lifted off the job.

After the pattern has been withdrawn from the mould cavity, the exposed surface has a relatively coarse and open texture. Chamotte paint is therefore applied to the surface as a slurry, by both hand and trowel, and is sleeked into the interstices of the larger compo grains. The mould is then allowed to stand for 2 to 3 hrs. to harden and to allow the moisture to migrate into the moulding compo. A final coat of alundum wash is then applied with a soft, flat brush.

To prevent vertical faces from caving in during drying, flat plates are wedged against parallel faces, wherever possible, with long steel tie rods. The mould is then plated over and portable, high-temperature gas driers are applied. The drying cycle consists of a slow initial phase at 200 deg. C. to remove added water to a sufficient depth to give adequate mechanical strength to the mould. If this phase is hurried, cracking invariably results. The final stages of drying are carried out at not less than 500 deg. C. The object of this high temperature drying is to remove chemically combined water from the immediate mould face. The top part mould faces and the cores are treated in a like manner and stove dried under similar temperature conditions. After drying is completed, the cores are inserted into the mould, hook holes and cracks are caulked up and the top part is placed in position.

It will be appreciated that there is tremendous "lift" during the casting operation, and so adequate binding-down arrangements have to be made for both top parts and cores. It is usual to preheat the completed mould cavity prior to casting.

At this stage, the mould resembles a large fired cavity of an aluminous nature which has a high spalling resistance, and it is this factor which enables the casting to be poured in a relatively slow manner. Fig. 2 shows the compo being stripped from a casting during the easing operation, while Fig. 3 shows a close-up view of the compo at the mould/metal interface.

To summarize, it can be said that providing the raw materials are satisfactory, the rules to be observed in good compo moulding are: (i) The mould or core face should be rammed hard; (ii) the chamotte paint should be well applied and sleeked into the open surface of the compo; (iii) the alundum wash application should be even and not applied too thickly, and (iv) the mould and cores should be thoroughly dried so that when this operation is complete the mould has a hard, impervious refractory skin, an open back, and adequate dry-strength to maintain the shape of the casting.

Compo *v.* Bonded-silica Sand

It is intended to deal only briefly with this subject as the physical properties of the two types of moulding materials indicate the differences which are found in practice. The most important difference between compo and bonded silica sand is the widely differing thermal-expansion of sand at all temperatures during drying and casting, as compared with the relative stability of compo. For this reason, both natural and synthetic-bonded sand moulds have to be very heavily nailed, usually with 5-in. nails at 1½-in. spaces. Due to the effect of radiation from the rising metal in the mould, particular attention has to be paid to the top part which undergoes the most severe punishment in these circumstances. Sand moulds are consequently poured as fast as possible. To illustrate this point, a 120-ton mill housing observed by the writer in the USA was cast from three ladles with 4½-in. dia. stoppers simultaneously. The whole casting operation was over in 3 to 4 min. A similar type of casting made in compo usually takes about 15 min. to cast. The facing sand used on heavy castings is a part-bonded natural sand which is suitably blended with silica flour (to reduce metal penetration) and bonded with fireclay and bentonite. The deposit of naturally bonded Venango sand in the Pittsburg area of the USA is well suited to the production of heavy-sectioned castings.

FIG. 3.—*Close-up view of compo at the mould/metal interface.*

It is usual to have a compo top part in conjunction with a dry-sand bottom part for reasons that have already been explained. The thickness of the metal section is the main consideration when deciding whether to mould a job in dry sand or compo. Large flat areas are prone to scabbing when sand is used unless they are very heavily nailed, and in such instances it is usually better to use a compo facing sand. As a general rule, compo moulding commences when the skin drying and dry-sand methods have reached their limits.

Where a core shape lends itself to strickle work, it is an advantage to use a compo loam and to finish off the outside of the core in chamotte paint with a final coat of alundum paint. This method gives better collapsibility than the conventional sand core. Special formulations of compo have to be used where cores are subject to extreme metal penetration, and in re-entrant angles.

Continental Practice

In certain large steelworks in Central Europe, the practice is to use only crushed chamotte grog bonded with clay. This chamotte facing is of a relatively coarser texture than compo. It has a higher permeability and is less plastic. New facing chamotte is rammed to the pattern and backed up in the first place with reclaimed chamotte and finally with backing sand. A typical chamotte facing mixture is: 3 parts by weight of 2 to 5 mm. chamotte, 3 parts by weight of 1 to 2 mm. chamotte, 1 part by weight of clay. The mixture contains 7½ per cent. water.

In one foundry, the surface of the mould is treated with alundum only, prior to drying, whereas in another foundry, the practice is to use chamotte paint followed by alundum wash. The final drying temperatures are in the range 750 to 900 deg. C.

Nickel Shortage Likely Until 1960-65

Fears that supplies of nickel were being diverted from the defence stockpile to industry led to a survey being made into the supply and distribution of nickel in the US. Now, Mr. Weeks, US Secretary of Commerce, has told Congress that it may be 1960 or even 1965 before the present shortage is relieved. The supply of primary nickel available would not meet the nation's full requirements for several years, he said. The expansion of the free world supply now under way or definitely planned might met the US need fully by 1960-65—when such expansions were due to materialize.

Mr. Weeks added that there should be a fair and equitable distribution of available supplies for non-defence purposes, and a co-operative understanding in the industry would be preferable to Government control of distribution.

"It is abundantly clear that the inadequate supply of nickel for all purposes has retarded and is retarding industrial expansion in several areas," he concluded.

Welding Supply Firm's New Premises

A reception at the Dorchester Hotel, London, was held for the Press and executives in the metal industries this week to mark the opening of the new Feltham (Middlesex) works of Eutectic Welding Alloys Company, Limited. Mr. A. J. Speakman, deputy director of the British Productivity Council, was the principal guest and both he and Mr. R. D. Wasserman, governing director of the company, addressed the assembly. The latter explained that the firm came to this country five years ago, following pioneer work on the Continent and in America in supplying materials for and providing technical instruction in low-heat-input welding. Examples were exhibited of welding repairs carried out with the company's products and processes on various components, including iron and non-ferrous castings.

Mr. RONALD H. WESTON, works manager, Aiton & Company, Limited, of Derby, has been elected president of the Derby and District Association of the Engineering and Allied Employers' National Federation. Mr. Weston is a past-president of Derby Society of Engineers, and a member of the Institute of Mechanical Engineers.

Latest Foundry Statistics

According to the Ministry of Supply the output of aluminium castings during October was 6,455 tons, 1,897 tons were from sand moulds, 3,308 tons as gravity-die and 1,250 tons as pressure-die-castings. The production of magnesium castings was 245 tons.

As reported by the Council of Ironfoundry Associations the following number of ironfoundry workers were employed in the United Kingdom during the week ending September 29:—Males, 131,883 and females, 9,984 making a total of 141,867. Compared with September 1, the total has declined by 753 and with October 1, 1955, by 2,860.

As stated in the *Bulletin* of the Iron and Steel Board and the British Iron and Steel Federation, on November 10 there were 20,490 people employed in steel foundries. This is an increase of 50 over the previous month, and 110 more than a year ago. During November the average weekly production of steel castings was in the order of 7,300 tons. This is the highest figure amongst those appearing in the table covering steel output since 1937.

Productivity and the Worker

Mr. Robert Carr, Parliamentary Secretary to the Ministry of Labour, addressing the Coventry Productivity Association on January 7, said that any resistance by workers to the introduction of new production methods would mean heavy and long term unemployment. Provided the country could maintain a high and stable level of total employment, and an expanding national economy, workers should not be afraid of periods of redundancy. Full employment could not mean a frozen pattern.

British Industry must be prepared to introduce new techniques to compete with other countries, and Mr. Carr stressed that the higher productivity resulting would be the ally of full employment. He emphasized the importance of joint consultation on matters of employment planning.

Mr. R. S. BINMORE has been appointed a director of Ley's Foundries and Engineering, Limited, of Derby.

Mr. H. M. SELLS has been appointed field manager of the Scottish district of British Oxygen Gases, Limited. The appointment took effect from January 1. Mr. Sells will be based at Glasgow.

Scottish Pig-iron and Steel Output

For the first time, annual steel production by the Colvilles, Limited, group of companies has exceeded 2,000,000 tons, and this record is likely to be broken this year when the new Ravenscraig works comes into operation in the autumn.

The 1956 output of 2,006,256 tons was achieved in spite of labour troubles last summer which included a strike of maintenance craftsmen. In 1955, the previous best year for the group, 1,889,801 tons were produced.

There were also increases in pig-iron production at the Clyde Iron Works of 635,978 (633,506) tons and at Dixon's Iron Works of 109,886 (103,382) tons. Over the past seven years the group's steel and pig-iron production has risen from 1,887,100 tons and 488,000 tons respectively to 2,006,000 tons and 745,800 tons. The previous best steel years were 1955 and 1950. Pig-iron output showed a steady increase from 488,000 tons to 648,000 tons (1954) and then jumped in 1955 (the first year to include the output of Dixon's Iron Works) to 736,800 tons. The new Ravenscraig plant will have an annual ingot capacity of 400,000 tons, and this may be doubled later by the installation of additional melting furnaces.

The group is the leading producer of steel plate in the UK, providing more than one fifth of the total output, mainly for the shipbuilding industry. It is the chief supplier to the shipyards in Scotland and Northern Ireland.

Colvilles is responsible for about four fifths of Scottish steel output so that the estimated Scottish output for 1956 will be 2,500,000 tons. If this figure is reached it would set up a new record, the previous best year being 1930 when output was 2,426,200 tons. In 1939, 1,875,400 tons of steel ingots and castings were produced and output has fluctuated between the 1950 figure and the 1,747,200 tons of 1945. In 1955, 2,343,900 tons were produced. There have been similar variations in the pig-iron output from 481,000 tons in 1939 to the estimated total for 1956 of 930,000 tons. The previous best output was 947,100 tons in 1954.

Export Achievements of BIMCAM

The part played by measuring and control apparatus in such achievements as the world speed records on land, sea, and in the air, and the air altitude record and in the new fields of automation and nuclear power, were stressed by Mr. F. J. Erroll, Parliamentary Secretary to the Board of Trade, at the annual luncheon of the British Industrial Measuring and Control Apparatus Manufacturers on January 8.

In a general review of the economic situation, Mr. Erroll said consumer demand had been stabilized, the investment boom moderated, and the level of imports in the first 11 months of 1956 was only 1 per cent. higher in value than in the previous year, while exports were 6 per cent. higher in volume and 10 per cent. higher in value.

The export achievement of BIMCAM was referred to by the chairman, Mr. R. G. Kent. Members' water meters were working in every country in the world, and process-control apparatus was putting new life into the nerve centres of primary and basic industries everywhere.

The association's 36 member-firms represent more than 90 per cent. of the productive capacity of the industrial instrument industry in the UK.

Stewarts and Lloyds Increased Output

Increases in output ranging from 3 per cent. to 15 per cent. are listed in the annual report of the directors of Stewarts and Lloyds, Limited, for the year ended September 29. Compared with 1938, tonnage of pig-iron has risen from 1,117,000 tons to 1,795,000 tons; steel ingots from 675,000 tons to 1,504,000 tons; spun-iron pipes and castings, from 343,000 tons to 477,000 tons, and steel tubes from 423,000 tons to 973,000 tons.

The group profit of £16,523,000, an increase of £3,200,000, include Stewarts and Lloyds, £9,532,000 (up £2,921,000); home subsidiaries, £4,533,000 (down £3,000); and trade investments and overseas companies £2,458,000 (up £282,000). Charges include:—Purchased raw materials, fuel and power, £46,167,000 (£38,904,000); wages, salaries, State insurance, £28,579,000 (£25,013,000); manufacturing and general expenses, £14,070,000 (£12,474,000); delivery costs, £8,990,000 (£7,986,000). The ordinary distribution is held at 17½ per cent., and the proposed scrip issue takes £10,000,000 of reserves.

British PT Oxygen Gun for US Company

An agreement with Kaiser Engineers, of Oakland, California, in connection with the P.T. oxygen gun, has been concluded by the Steel Company of Wales, Limited. The gun has been developed by the company for use in open-hearth furnaces for rapid carbon elimination and it is in regular use on all furnaces in the Abbey Works melting shop at Margam.

The operation can be fully mechanized and there is no interference with charging or tapping operations as occurs when a lance is inserted in the front or back of the furnace. More than 60,000 cub. ft. of oxygen per hour can be delivered to the furnace, greatly increasing the rate of carbon removal in the lower carbon ranges. The subsequent decrease in the tap to tap time considerably increases steel production.

The rights granted to Kaiser Engineers to make, use, sell, and sub-license the gun apply throughout the world with the exception of Europe.

British Standards Institution

The *Information Sheet* of the British Standards Institution for December lists amongst "Revised Standards" B.S. 18:1956 Tensile testing of metals, price 4s. It gives definitions and specifies the dimensions of standard test-pieces; proportional, machined and unmachined, of circular, square, rectangular or hexagonal cross-section, including those for wrought and cast material; non-proportional, for sheets, plates, strip, flat bars, sections and tubes, and includes clauses on test-pieces for tubes and wire. Under "Amendment Slips" there is one to B.S.779:1938 Cast-iron boilers for central heating and hot-water supply (amendment No. 2) PD 2652 and to B.S.806:1954 Ferrous pipes and piping installations for and in connection with land boilers (amendment No. 1) PD 2655. Publications which have been temporarily out of stock but which are again available include B.S.1288:1946 Manganese steel gas cylinders for carbon dioxide, nitrous oxide and ethylene, 3s. 6d. and B.S. 1430:1947 Aluminium rainwater goods (cast and extruded) 4s.

Foundrymen Discuss . . . .

Internal Chills in Moulds for Steel Castings*

In Cardiff, at the IBF conference, questions were asked regarding tin-dipping versus *tin-plating and the best sizes of chills to use in relation to the metal section being considered. The importance of cleanliness and storage of chills was stressed and chill design discussed. Finally, the use of chaplets, their size and material, and the need for a greater range of stem-thicknesses and careful head-design was covered.*

Opening the proceedings, when the Paper by Mr. G. W. Miles on the subject of internal chills for steel castings was formally presented, THE CHAIRMAN (Mr. J. Blakiston) commented that there was often quite a lot of criticism of steel castings in the engineering industry—it was not for him to say whether or not it was well founded. It might be that chills had a very considerable interest from the casting point of view, as opposed to the metallurgical or melting-point aspect, and the Paper as presented by Mr. Miles might give some enlightenment on the matter.

(Mr. Miles then presented the Paper.)

Initiating the discussion, MR. V. C. FAULKNER (past-president of the Institute of British Foundrymen) said that when he had originally edited the Paper, he had changed its title to "Chaplets and Internal Chills in Moulds for Steel Castings," but he noted that in its final form the word "Chaplets" had disappeared. Expressing the view that the word should be included in the title, he suggested that more people were interested in chaplets than in ordinary chills.

MR. MILES suggested that the title could be "Inserts in Moulds for Steel Castings"—the word "inserts" being all embracing—or, preferably, "Chaplets and Chills. . . ."

MR. J. M. MIDDLETON noted the reference in the Paper to the work of Taylor and Rominski, who had stated that tin-dipping of chills and chaplets gave inconsistent results and that coating with nickel or copper was the most satisfactory. Most of the chaplets he had seen were tin coated, and he had noticed that Mr. Miles, in his experiments, had used tin for some copper and also unplated chaplets and chills. Did the Author feel that tin coating was satisfactory, or was cleanliness the most important factor in the use of chills and chaplets? Had he any comments to make regarding tin-dipping *versus* tin-plating? Electroplating was said to give the best results.

Also, he asked if the Author could give any general rule as to the best sizes of chills to use relative to the size of the section being chilled. From published information it would appear that the best results were obtained when the chill weight or volume was from 2 to 5 per cent. of the weight or volume of the section being chilled. For example, if it were below 2 per cent. the chill welded easily, but the chilling power was low, whereas if above 5 per cent. chilling was good but the fusion of the chill with the casting was poor. He had noted from the Paper that ¾-in. dia. chill bars were found to be the most satisfactory, those being some 5 to 6 per cent. of the volume of the section being chilled. He asked if the Author considered that 5 to 6 per cent. was the optimum relationship between the chill and the chilled section.

MR. MILES, discussing first the volume of the internal chill, said it would be noted from the Paper that the round chills were less likely to introduce defects than were those of square-section. He suggested, therefore, first, that sharp corners be omitted; second, although for those experiments he had quoted percentage by volume, he was concerned primarily with the fusion of the chill with the casting, rather than with just attempting to chill adequately a section which could not be fed by conventional methods. In the experiments described, there was ample metal to secure fusion. For the weight or volume of the chill in relation to the section to be chilled. he said he had quoted from 5 to 6 per cent., and when one came to consider the actual job on the floor he did not think that very much trouble would be experienced anywhere within that range. He would suggest about 5 per cent. as the optimum size.

Coming to the question of coatings, he had used ordinary commercial chaplets. Mr. Middleton had put forward the idea that copper and nickel coatings were the most consistent; but he felt that cleanliness and the strong adherence of the coating to the chaplet so that it did not vaporize were the primary features.

Shotblasting Recommended

MR. R. J. RICHARDSON said that in his experience a better result was obtained by ensuring cleanliness rather than any consideration as to the coating used. In dealing with dry-sand moulds, at one time his practice was to put the chills into the moulds before they went into the oven for drying. However well-coated they were at that stage, they caused trouble later due to a soot deposited on the chills and condensation forming rust spots where the coating was not very satisfactory. There he had found that the ordinary mild-steel or special form of cast-steel chills, provided they were shot-blasted and put into the mould immediately prior to casting, gave better results. That practice could be applied to both dry- and green-sand moulds; with the green-sand moulds, the chills should not be inserted too early.

With regard to optimum size, Mr. Richardson recalled an experiment which he and his colleagues

* Paper printed in the FOUNDRY TRADE JOURNAL, August 9, 1956.

had carried out many years ago when they had to make some roller-bearing balls. They were rather large, as for a railway turntable, but they had to be sound. Finding they could not feed the castings by orthodox methods economically, they had carried out experiments by casting on to a ½-in. dia. rod two internal ball chills in the form of a dumb-bell and inserting them into the mould. Later, they had had to increase the chill diameter a little and had found that about one-third of the diameter, *i.e.*, a 2-in. sphere inside a 6-in. ball, gave no tendency to blow, and the amount of feed metal required was negligible. The head—though it was not really a head—was enlarged to 1-in. or 1½-in. dia., and it was put on in case there was a tendency to blow. Working that out, it came very near to the optimum figure Mr. Miles had obtained, using plain bar inserts as compared with the completely rounded inserts.

MR. MILES said it was very pleasing that such experiments as those mentioned by Mr. Richardson had given somewhat similar results to his own, and also that cleanliness was regarded as all-important in foundry practice.

Importance of Proper Storage

MR. A. H. CANNARD expressed surprise that, in all the comments made about the cleanliness of all inserts in moulds, and even the coating of chills, no mention had been made of keeping such things dry; that was a most important factor. He had found that even at room temperature the chills, particularly uncoated ones, tended to pick up moisture, which was bound to be released during the casting process. He invited the Author's comments on the matter.

MR. MILES said he gathered Mr. Cannard was referring mainly to keeping chaplets dry. He had mentioned in the Paper, of course, that chaplet storage was important. Rust-covered chaplets or chills were certainly undesirable, and in his presentation of the Paper, he might have skimmed rather too lightly over the matter. Perhaps he should have emphasized it; but since cleanliness had been a topic throughout the discussion, he would assume that the word would be regarded as meaning also the avoidance of rust.

Of the three types of chaplets used, the roller type was not prepared in any special form, but was just taken from the ordinary foundry stores—and he knew that in storage it was possible to pick up some rust. Condensation could very easily occur and he instanced the statement of a previous speaker that massive chills should not be inserted in a mould too soon because of the risk of condensation.

Chills

MR. E. DAYBELL said there was no doubt that all who were concerned with steel castings were interested in chilling, and he urged that the lack of detailed information on chilling was a matter that should be put right. Some steelfounders had developed chilling practice to an art and obtained very good results, but, unlike Mr. Miles, they had not put on to paper the information they had gained. However, there was still a long way to go, and the sooner more information could be recorded, the better it would be for all concerned.

It had been said that internal chills should not become part of the casting. That was a point that should be stressed, because one did not want people to think they were making sound castings, suitable to meet a certain specification, just by using an internal chill. Another matter which needed deeper thought was the design of chills. From experience, he had found that designs had to be thought out carefully if the metal were to lie around them properly and if defects around the chilled area were to be avoided.

With regard to the proportions of internal chills, he would have thought that those mentioned earlier were a little on the lean side. In his organization, the chills used were in the region of 8 per cent. of the weight or volume of the casting or section being chilled, instead of the 5 per cent. Mr. Miles recommended.

Finally, he asked if Mr. Miles had any information about special precautions which should be taken relative to a chill which was standing upright in the mould and one which was lying horizontally. Could he say anything about design?

Present Position

MR. MILES replied that in presenting the Paper, he was not advocating the wholesale use of internal chills, but was putting forward considerations which should be taken into account if internal chills appeared to be an economic proposition.

With regard to literature on chills, he had found that very few people would make themselves "guinea pigs" in respect of the use of internal chills. There was a reasonable amount of literature, however, on external chills, possibly because one could plate them and, furthermore, one could vary particularly their thermal conductivity; there was no question of introducing defects into the castings, provided the metal was allowed to flow. It did appear that in the past, founders had fought shy of the topic of internal chills. He himself had not proposed to do a lot of experimental work, but had merely tried to put together what appeared to be the rather scanty information which people were confident to publish. Naturally, people had worked on the subject in foundries, in training schools, and the like.

Internal-chill design was important, and had to be related to another matter mentioned by Mr. Daybell, namely, the vertical and horizontal positioning of internal chills. The main thing was to try to avoid any horizontal plane surface. Mr. Miles said that he had advocated radiused bars; even if one were using, say, square or rectangular-section chills, they could be so positioned in the mould that there was not really presented a horizontal plane. If one had a square-section chill in a horizontal position one could rotate it so that it was held with the diagonal horizontal. Again, if the chill stood vertically, a taper would avoid the

flat plane. A necessity was to avoid any really sharp corners which would, of course, rapidly melt away, and also to avoid flat planes, which it was difficult to fuse in with the casting.

MR. DAYBELL said a simple example of incorrect design was the common horseshoe nail which had been used for years. It had a flat top, which caused trouble when the nail was used in a vertical position in the mould, and he had yet to find a source of supply of these nails with a pointed top.

MR. MILES replied that he was not trying to condemn outright any particular shape unless he could put forward what he considered to be a far better one. He was merely putting forward a principle, that if possible flat surfaces should be avoided.

Radiograph Disclosures

MR. D. H. SCOTT referred to a problem he had recently come up against. The castings in question were float boxes, chaplet supported. The normal method of coring had given castings which withstood all tests prior to their supply for the Swedish Navy. Here, they had been submitted to X-ray testing, which revealed the chaplets in the castings—one could see slight cavitation on the X-ray plate and also there were round and opaque spots which were obviously more dense to the penetration of X-rays than were even the ribs of the castings where there was 3-in. of metal. He asked whether the Author had experience of similar results being obtained where chaplets were used.

MR. MILES queried if the opaque spots were radially disposed.

MR. SCOTT said they were not, but were in the position where the chaplet had been. There was no displacement of the core, and the chaplet had been placed at the bottom; in eight different castings there were eight spots.

MR. MILES said if there were opaque spots visible on a radiograph, as opposed to a microradiograph, he would say they were not the metal.

MR. FAULKNER recalled an addendum the Author had made to the Paper concerning a fracture in a steel casting which broke through the chaplet, and asked if the chaplet were of mild- or of manganese-steel.

MR. MILES replied that it was an ordinary "top-hat" chaplet. What he had not made clear was that the plate had been rested across the side cores and the chaplet positioned on top of that. He had raised the subject because the plate acted as a horizontal plane area and there had been no fusion at all; he was concerned primarily with the use of the plate as an example of a horizontal surface which did not form a complete union. The method was not used in practice.

Supply Position

MR. FAULKNER asked if the industry was satisfied that the materials from which chaplets were made were such as to meet its needs fully.

MR. MILES replied that in the steel industry, if one excluded such types as stainless-steel castings (which might have to be subjected to corrosive media), he considered that mild-steel chaplets were fulfilling their purpose very satisfactorily. It was to be expected, if carbon-steel was being produced, there would be a gradient in carbon between the cast metal and the chaplet. He could not express an opinion, however, concerning the casting of Monel-metal and other metals.

Chaplet Materials

MR. G. F. TAYLOR, referring to composition, asked whether, if one were casting various types of alloys, Mr. Miles would suggest that every chaplet used in a particular alloy should be made of the same material. If there were to be fusion with the casting, would he put a heavier-stemmed chaplet in the bottom of the mould than in the top?

MR. MILES said he had already mentioned stainless-steel castings, which, from his experience, necessitated the use of a non-corrosive material for the chaplets. On one particular occasion, thick-stemmed chaplets of ordinary mild-steel were used, and their use became apparent.

Some founders tended to err in respect of the minimum number of chaplets to use, and sometimes too many were employed. He agreed that there was no need to stick to the same size of chaplets in all parts of the casting. Sometimes someone would say that the job needed a little extra support, and the usual thing was to put in two or three more chaplets. The judicious selection of an insert which was just capable of doing its job was the best course to follow.

MR. TAYLOR said that what he had meant was that standard chaplets provided for foundries had the same gauge of stem for all the varying sizes (double-type stud-chaplet). In a ½-in. uniform-sectioned casting, there would not be a uniform temperature-gradient throughout on casting, and therefore a different-gauge stem ought to be used in the top half of the mould as compared with that in the lower half, whether it was of mild steel or alloy.

MR. MILES said he believed there was an adequate supply of chaplets of different stem-thicknesses, and it was a matter of selection.

THE CHAIRMAN, in thanking Mr. Miles for his Paper and for the able way in which he had handled the questions put to him, said there was great scope for further investigation of, and further papers on, the subject of chaplets. The manufacture of chaplets seemed to be concentrated in one or two hands and had become rather stereotyped. Occasionally a Patent chaplet appeared on the market, but that was not what the industry needed; it wanted a greater range of varying stem-thicknesses and a careful head-shape design to conform with experience gained in practice.

IN the December 27 issue of this JOURNAL on p. 766 under the heading *Publications Received*, the old address of Metallurgical Engineers, Limited, was given. Information has now been received to the effect that those wishing to obtain copies of the publication referred to—"Proceedings of the International Recuperator Conference (Paris, September, 1955)" should write to the company at their new address—Prince Rupert House, Queen Street, London, E.C.4.

Induction Stirrers

Electric-induction stirrers will shortly be employed in a foundry to produce alloy-steel castings. One of these is now being installed on an electric-arc furnace and another is planned for a second furnace, both furnaces being located in the (American) General Electric Company's Schenectady steelfoundry; it is estimated they will cost approximately $200,000.

The two electric-arc furnaces in the Schenectady foundry produce 13,500 tons of steel annually; one has a 13½-ft. dia. with a capacity of 22 tons whilst the other, 11-ft. dia., will melt half that amount. Eleven direct-current GEC motors and a motor-generator set will be utilized in running the furnaces and the induction stirrers. Two separate water systems will be used for cooling each of the furnaces and their associated equipment, one for normal operation and the other as a stand-by. Each system will use water at the rate of 16 gall. per min.

Stirrer Assembly

The stirrer assembly, including coils and container, will weigh 7½ tons on the larger furnace and 5¾ tons on the other. To protect the coils from overheating, a warning system will be incorporated. This system will include temperature-measuring devices consisting of Thermistors installed at various positions on the furnace bottom and will indicate the temperature of the water in the coil-cooling system and of the furnace bottom (Fig. 1). If a predetermined maxmum safe temperature is exceeded, these Thermistors will be set to give an alarm signal. When the alarm is given, a horn will sound and the stirrer will automatically stop. If the coil or its coolant become overheated, a bell will sound and the stirrer will be stopped. Signal lights will indicate the nature of the trouble and the exact hot-spot can be found by manipulation of the indicating-temperature dials on the panel boards, which may be connected into any one of the Thermistors.

Current is to be supplied to the stirrers on both furnaces by a special single-phase 1.4 cycle commutator-type generator rated at 250 kva at 0.2 power factor, and driven by a 280 h.p. 60-cycle, 440-watt, 1,770 r.p.m. three-phase slip ring, induction motor. Excitation will be provided by a specially built Schrage phase-and-frequency converter with rotating primary and regulation windings and a stationary secondary winding. The moving magnetic field generated by the current flowing in the stirrer coils may be made to move in either of two opposite directions so that the flow of metal in the furnaces may be directed up towards the spout for pouring, or towards the slag door for slagging-off operations.

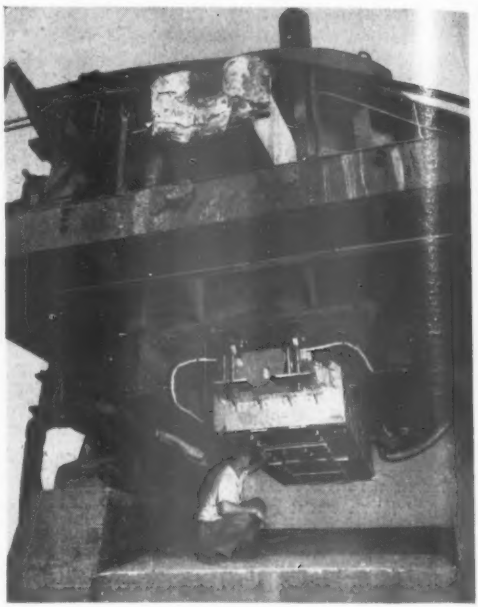


FIG. 1.—*An engineer making a final inspection of the stirrer mechanism which is attached to the bottom of a 13½-ft. dia., 22-ton capacity electric-arc furnace at the Schenectady steel-foundry of the General Electric Company, of America.*

Germany's Rising Steel Output

Current rate of steel output, greater than that of the UK, is reported from western Germany. Last year 23,200,000 tons of ingot steel were produced and output has now reached 74,000 tons a day. Production is expected to rise by a further 8 per cent. to more than 25,000,000 tons this year. The principal factor in this expansion is continued investment. In 1956, about 51 per cent. of investments was spent on rolling mills, 18 per cent. on ingot steel, and 17 per cent. on pig-iron production.

German steel output last month was 1,854,000 tons, against just over 2,000,000 tons in November. Output for 1956 was 8.7 per cent. up on the 1955 figure, slightly below the anticipated figure of 23,400,000 tons.

AEA's Commercial Department

A commercial department, within its industrial group, to handle sales of uranium, plutonium, thorium, graphite, and other similar materials has been set up by the Atomic Energy Authority.

Within the general policies laid down by the authority the new department will be responsible for negotiating terms and conditions of sale, including the determination of selling prices. The manager of the department is Mr. W. P. Warren, at the UK Atomic Energy Authority, Industrial Group Headquarters, Risley, near Warrington (Lancs).

Radio-isotopes, stable isotopes, and special requirements for small quantities of research materials will continue to be handled by the research group.

Largest Steel Casting?*

Mammoth Roll Housing Produced by Bochumer Verein

More than 200,000 people visited the International Foundry Exhibition held last September at Düsseldorf, and all were greatly impressed by what is claimed to be the largest steel casting ever produced, which stood at the entrance to the exhibition. This casting, a cast-steel roll-stand (of finished weight 257 tons) was made by the Bochumer Verein für Gusstahlfabrikation A.G. for the Austrian Vöest steel works at Linz. It has the following main dimensions: Overall length 38 ft.; width 14 ft., and thickness of head 6 ft. The casting (Fig. 1) is of particular interest to foundrymen and the details of its production contained in the article which follows have been given by the foundry manager Dipl.-Ing. G. Schmidt:

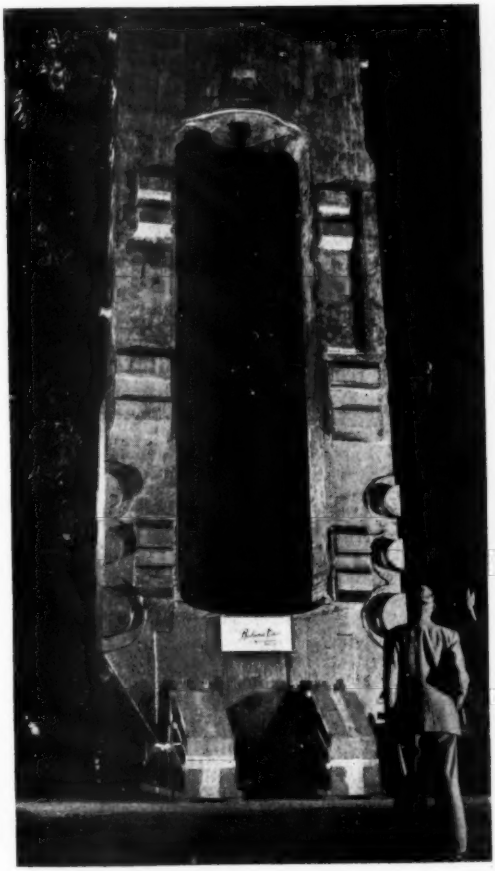


FIG. 1. — An impression of the large size of the roll-stand casting produced by Bochumer Verein on exhibition at Düsseldorf is gained by comparison with the size of the onlooker.

The pattern which required 460 cub. ft. of timber was produced by the patternshop of Bochumer Verein. It took seven patternmakers working continuously for five weeks to make it. Bearing in mind the calculated metal contraction of 1.8 per cent. or $\frac{7}{32}$ in. per ft., the pattern had to be 8 in. longer than the required casting length. This estimation proved to be correct and after it was made the roll stand conformed with the measurements on the drawing.

In order to speed up the production of the pattern and to facilitate transport, the pattern was made in four sections, comprising one headpiece, two side-pieces and one base-piece. These four pattern sections were made simultaneously and independent from each other. They were later assembled and the resulting completed pattern was checked for accuracy (see Fig. 2).

Moulding

The largest of the moulding pits in the foundry was selected for the moulding of the roll housing; it had the following dimensions: 43 ft. 6 in. long, 26 ft. 6 in. wide, and 13 ft. deep. A sand bed five ft. deep was rammed at the bottom of the pit and covered by a reinforcement of steel rails closely placed together, the remaining gaps being rammed with moulding sand (Fig. 3). A second layer of rails placed at right angles to the first layer was then placed on top and similarly rammed. This foundation ensured sufficient safety even for the high casting pressure to be expected. The weight of the 1,500 ft. of rails for this double reinforcement was 27 tons.

Special attention was given to the choice of moulding material to enhance the surface appearance of the casting, the main constituent of the special moulding sand being a first-class refractory material, chamotte. The rammed mould itself had to be further reinforced with rails, irons and hooks so that the enormous pressure of the liquid steel at the time of casting could safely be retained by the mould walls.

* Abstracted from *Hüttenzeitung*, the house organ of the Bochumer Verein concern.

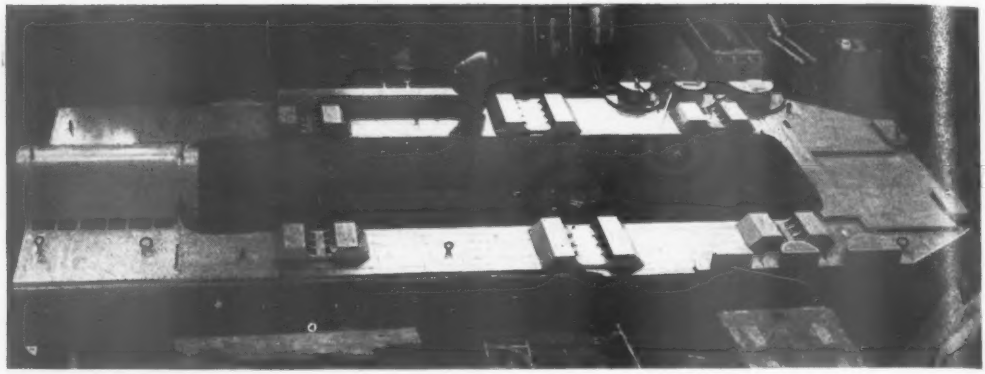


FIG. 2.—*View of the pattern for the mammoth steel casting lying in the firm's patternshop. It was made in four sections and required 460 cub. ft. of timber.*

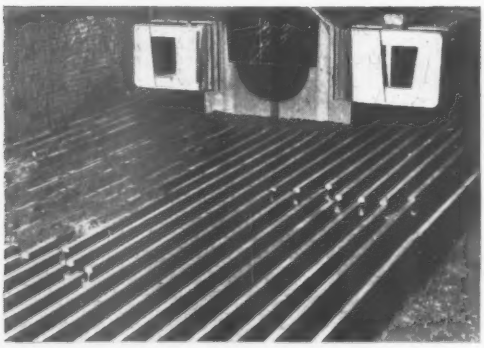
Moulding Box

After ramming on the sides, a top box, consisting of two parts on account of the large length and width, was placed on top of the rammed mould which was at that time flush with the upper edge of the pattern. The two top box-parts combined had dimensions of 44 by 18 by 3 ft. and weighed 290 tons. These top parts were secured in the usual way with double sets of rails, bars and sandhooks —an operation which required 7,000 sandhooks equivalent to 18,000 ft. of round steel and 470 ft. of rails. The top boxes were also rammed with best heat-resisting moulding material.

Finishing and Closing

After the completion of moulding, the two top-parts were lifted each by two 100-ton cranes and deposited on prepared supports. Whilst moulders, working underneath the lifted top boxes, finished the dressing of these, the four parts of the pattern-head and bottom-piece and the two side-pieces—

FIG. 3.—*Roll-stand pattern in the moulding pit, showing the steel-rail reinforcement for the bottom of the mould.*



were withdrawn from the mould by overhead crane and the mould, then being fully accessible, could also be finished.

This work of moulding and dressing had to be done under very unfavourable temperature conditions at the time of severe frost in February 1956 and there was a great risk that frost would penetrate into the still undried mould. To overcome this danger, the moulding station had to be surrounded by a number of braziers which burned up to 20 tons of coke every 24 hours.

When mould and top boxes were finally dressed, first with a coarse dressing and later with a finish dressing, the top boxes were again put on the mould, but not before it had been cautiously dried by a set of gas burners before being fully baked at about 500 deg. C. This drying operation took 125 hours and consumed one-million cub. ft. of coke-oven gas. After the completion of the drying, the top boxes were again lifted off, but on supports and blacked with a highly heat-resisting dressing.

Coring and Closing

The cores for the bores were now inserted together with some chilling inserts which had been previously prepared from a steel of similar composition to that of the casting and rolled in the company's works.

The top boxes were now finally replaced on the mould and the assembly bolted down by six cross-heads which were screwed down, together with the moulding-pit reinforcement. Each of these cross-heads was calculated to withstand a buoyancy pressure of at least 100 tons so that the bolting arrangement alone was safe against a total buoyancy of 600 tons. Together with the weight of the two top boxes (290 tons) the total load was therefore 890 tons which meant that a provision for at least double the safety requirement existed, taking into consideration the maximum possible buoyancy pressure of 420 tons.

Casting

The quantity of liquid steel necessary for casting the roll stand was calculated to weigh 380 tons.

In order to pour this quantity into the mould with the required speed, six ingates were provided, fed by five runners. Each of these five runners was fed by a ladle holding about 70 tons of liquid steel (Fig. 4). The two heavy crane systems of the works, working one above the other, made it possible to suspend four of these five ladles very close together. It was therefore only necessary to mount the fifth ladle on the mould itself.

Melting Arrangements

It was desirable to charge as well as to teem five out of the six open-hearth melting furnaces at the same time. All these furnaces had to produce the same melt composition, and all had to be regulated to the same melting and pouring temperature in order to achieve the most favourable conditions for the casting of the roll stand. The simultaneous tapping of the furnaces and the pouring from the five ladles required a very accurate timing of the work of each individual engaged in the casting procedure. For this reason a "dress rehearsal" took place on the day before casting.

On the actual day of casting, the detailed planning, the fixing of the working timetable and the responsible co-operation of all connected with the job made it possible to achieve the melting, tapping and pouring operations with clockwork precision. Thus, on February 29, 1956, at the prearranged time, five of the open-hearth furnaces were tapped within five minutes, each supplying 70 tons into five prepared ladles, four of which were brought to their prearranged places above the mould, the fifth ladle being placed on the mould. When the head foreman gave the order to start pouring, five ladles discharged their metal and the liquid steel started to flow quietly into the mould. On looking down the risers it could be seen that the mould was filling satisfactorily and within 15 minutes the whole casting operation for the heaviest steel casting in the world was successfully accomplished.

At a predetermined time after the tapping of the other five furnaces, the sixth open-hearth furnace was tapped, and about 30 tons of steel from this furnace were used as make-up for topping the risers, which were kept hot for 45 hours by electric heaters in order to keep the metal in them liquid.

When steel castings of large dimensions are made, the rate of cooling after casting is of great importance. If a steel casting with varying wall thicknesses, as required by the designer, were to be removed too soon from its heat-insulating casting pit, stresses would be created which could in certain circumstances endanger the casting. In order to be able to assess the correct moment for the burning-off of runners and risers and the withdrawal of the roll stand from the pit, thermocouples had been built in into the mould. In this way, using a 6-point temperature recorder, the cooling progress could be observed. Twelve days after casting, the moulding sand around the risers was removed and these were burnt off about 8 in. above the casting proper, using oxygen/coke-oven-gas cutting torches. The complete cooling of the roll stand took 46 days and the stand was taken out of the mould when its temperature had fallen to 200 deg. C.

Fettling and Annealing

After removing the casting from the pit the roll stand had to be transported into the fettling section set apart for dealing with such large castings. This transport problem had to be planned with equal attention to detail as was given to the casting operation itself. It took eight days to remove adhering moulding material from the casting, for which operation pneumatic chisels were used. When the casting was freed from sand, it was brought into an annealing stove of dimensions, length 49 ft. and width 19 ft., this being one of the largest in the steelfoundry industry. The annealing process lasted 720 hours (30 days) and was divided into two periods of heat-treatment. The stand was first subjected to a soft-annealing process and after this the remainder of the ingates were removed with the aid of milling cutters and ground with oscillating grinders. At this stage the stiffening pieces which had been added to the casting for foundry technical reasons were also removed. The final fettling and trimming was carried out by special finishing fettlers and after completion of the heat-treatment a descaling operation was carried out.

FIG. 4.—*Pouring in progress—five 70-ton ladles of steel were used, with a sixth for "topping-up."*

Fifty Years of Conveyors

Britain was just settling down after the Boer War when Geo. Robson & Company (Conveyors), Limited, Sheffield, made its first conveyor of any size. The firm was established in 1906 and some of the earliest machines made are still giving good service up and down the country. They are mostly track grinders which were supplied to nearly every undertaking at home and abroad, while billet grinders went to most of the large British steelworks.

Two years after Mr. George Robson, formerly chief draughtsman at Edgar Allen & Company, Limited, had founded his firm, the first large plant was made for handling rubbish at a destructor works. Newspaper conveyors followed, as did those for steel strip and wire, which were able greatly to increase the tonnage which could be produced and handled. The GPO came in for the firm's attention in 1913 when mail sorting and handling was made easier and the company has continued to supply conveyors to the GPO ever since. In fact nearly every head Post Office of reasonable size in the country has at least one Robson conveyor. After chocolate, rubbish, newspapers, steel strip, and mail came Ford cars and they were followed by whalemeat (the company still supplying whaling factory ships).

To-day as Geo. Robson & Company celebrates its golden jubilee it is busy on heavy-duty conveyors for steelworks, skip hoists, elevators, and conveyors, for gas, electricity, and glass works, collieries, fish processing plants, oil and cake mills, maltings, and dozens of different foodstuffs. One of the most recent developments has been the manufacture of manipulating gear for the latest type of radiotherapy apparatus, some of it including electronic control gear.

Another Newfoundland Order for M-V

An order for a 20-mw. (c.m.e.r.) 3,600-r.p.m. steam turbine-generator set from the Montreal Engineering Company (on behalf of the Newfoundland Light & Power Company) has been received, in the face of stern Continental competition, by the Metropolitan-Vickers Electrical Company, Limited. The machine, which will be supplied complete with condensing plant and feed heating and deaerator equipment, is to be installed at St. John's power station, on the Avalon peninsula, where it is due to be commissioned in August, 1959. A 10-mw. Metropolitan-Vickers generating set was commissioned in this station last June.

The 20-mw. turbine will be a single-cylinder machine taking inlet steam at 850 p.s.i.g. 900 deg. F. and exhausting to a 14,000-sq. ft. condenser, which operates at a vacuum of 29¼ in. Hg. at the 20-mw. continuous maximum economic rating. Steam extracted from the turbine will operate four-stage feedwater heating and deaerating equipment, giving a final feedwater temperature of 345 deg. F. The a.c. generator will be a 25-mva. air-cooled machine, direct driven by the turbine at 3,600 r.p.m. and supplying alternating current at 13.8 kv. 60 c/s.

United Steel's Output Records

Record outputs of steel ingots and coke were achieved by the United Steel Companies, Limited, in the year ended September 30, 1956.

The following figures are given in the annual report:—Steel ingots, 2,660,000 tons (2,559,000 tons in the previous year); pig-iron, 1,534,000 (1,587,000) tons; coke, 1,602,000 (1,566,000) tons.

New Plant in Service at Scunthorpe

Two major items of plant—a new turbo-blower and a new open-hearth furnace—brought into service by the Appleby-Frodingham Steel Company, Scunthorpe, a branch of the United Steel Companies, Limited, have both been commissioned ahead of the scheduled dates. The turbo-blower, which is twice the size of the four existing units at Scunthorpe, is capable of delivering 150,000 cub. ft. of air per minute to the blast furnaces at a pressure of 35 lb. per sq. in.; the steam turbine generates 20,000 h.p. Because of the additional blowing capacity now available, it will be possible to obtain a higher output of pig-iron from the company's four blast furnaces.

Final preparations throughout the Christmas holiday period enabled the new 300-350-ton open-hearth tilting furnace to be ready for its first charge on December 27; the furnace was tapped for the first time on the following day. It is the third unit in the company's Frodingham melting shop, two earlier furnaces having been laid down in 1947. The bulk of the 120,000 tons of steel produced annually in the new furnace will be supplied to the Steel, Peech & Tozer branch of United Steel, where the additional steel is required for the Brinsworth continuous medium-strip mill, which is due to start up in mid-April.

The 300-350-ton furnace is designed primarily for firing by cold coke-oven gas and pitch creosote, but mixed blast-furnace and coke-oven gas can be used after minor modification. It is equipped with modern instrumentation and automatic control devices.

United Steel Companies Issue

Ordinary shareholders of the United Steel Companies, Limited, on the register at December 21 are offered 6,000,000 new ordinary shares of £1 each at £1 10s. a share in the proportion of three new shares for every seven shares held. Half the price is payable on acceptance not later than January 24 and half by March 20. Application for excess shares may also be made.

The United Steel Companies was the first of the iron and steel companies selected by ISHRA for re-sale of its equity capital to the public in 1953 and is the first to raise new capital by a rights offer since that event. The whole of the £9,000,000 is new money, no part of the issue being involved in any repayment of existing indebtedness.

The issue is being underwritten by Morgan Grenfell & Company for a commission of 9d. per share to include a sub-underwriting commission of 6d. per share, its own legal expenses, and a fee to Rowe & Pitman & Cazenove & Company for its services as brokers. Including the underwriting, total expenses are estimated at £242,700 and will be borne by the company. Provisional allotment letters were posted on January 9.

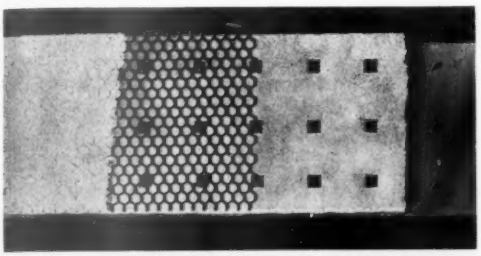
Open Venting Hose

As a result of investigations carried out by the JOURNAL staff in the matter of finding suppliers for open flexible woven hose of small diameters as substitutes for wax vents, samples of a braided fibre-glass sleeving have now been received from Jones, Stroud & Company, Limited, Highfield Mills, Canal Street, Long Eaton, Notts. An ideal construction is being determined for foundry venting purposes to make the material resistant to crushing, and with a weave as open as the original Swiss-made samples.

Equipment & Supplies

Steel Honeycomb Reinforcement

Causeway Reinforcement, Limited, of Victoria Street, London, S.W.1, is now producing a modern development of ceramic flooring supported in an iron honeycomb as used in Beaulieu Abbey in the fifteenth century: it is marketed under the trade name of "Hexmetal." This product is a fabrication of steel-walled honeycomb cells, which when loaded with a filler, acts both as a binder and a separator. It absorbs impact loads and vibrations, and inhibits cracking due to metal spillage; as a result it is claimed that it is an ideal medium for flooring in heavy and light industrial plants, and is also suitable for loading bays and roads subject to excessive loading and vibration.



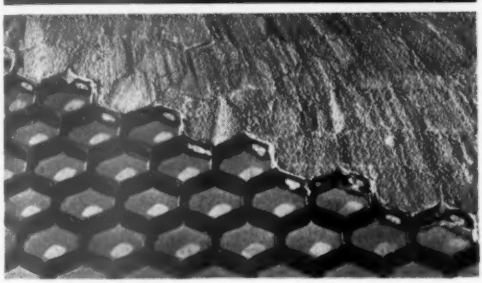


FIG. 1 (*top*).—*The stages of laying "Hexmetal" in a steel shell, right to left: Stage* 1. *The bare shell with Nelson studs welded direct to main shell. Stage* 2. *Monolithic refractory rammed up between studs. Stage* 3. *Hexmetal welded to studs. Filled and finished surface.*

FIG. 2 (*bottom*).—*A close-up of partially filled reinforcing in position on a floor surface.*

In foundries Hexmetal has two further applications. It is being increasingly used (Fig. 1) to provide a bone structure for those cupola linings which are made of monolithic refractory instead of brickwork. The metallic reinforcement is claimed to prevent the monolithic from shrinking and cracking. Second, flooring incorporating the honeycomb steel when laid in front of the cupola tapping point, prevents spalling which can be the cause of serious accidents at that particular point.

"Hexmetal" surfaces (Fig. 2) are claimed "nonslip" by virtue of the alternating surface tensions of the honeycomb. Filler cell-loading materials that may be employed are concrete, granolithic, asphalt, or any other flooring media dependent on the loading and corrosion problems involved. The honeycomb is available in steel, stainless iron, aluminized steel, or non-ferrous metal, and is manufactured in four forms, in stock sheets 10 by 3 ft., but it can be supplied in any size or shape required. It is claimed that this product represents a considerable saving in installation costs. Normally, a floor subject to heavy impact loading needs to be of high-grade concrete of at least 4-in. depth, when "Hexmetal" is employed only one inch is required on the foundation of inferior aggregate.

Oscillating Air Hoists

Martonair, Limited, Parkshot, Richmond, Surrey, are pleased to announce the introduction of a series of automatic oscillating hoists for applications where it is necessary for the load to be automatically oscillated, such as in washing, dipping and quenching treatment, degreasing baths, etc. Possessing all the features of standard hoists manufactured by the firm, the units may be manually controlled or switched over to automatic oscillation.

The hoists cannot be damaged by overloading and check valves prevent the load dropping if the air supply fails. When operated on manual control, variable speed may be obtained depending on the amount that the control valve trigger is depressed, together with the balance effect, whereby the load may be raised a few inches manually for easy positioning without recourse to the control valve. The magnitude and position of oscillation is completely variable, such that any length of oscillation can be achieved at any position of the lift within the maximum capacity of the hoist, and is obtained by the adjustment of the two trips mounted on the side of the piston. Speed of oscillation is variable for both raising and lowering by means of a pair of air-flow regulators which are incorporated. The normal maximum speed on both lowering and raising is 1 ft. per sec. The number of oscillations depends upon both speed and magnitude, and, with an oscillation of 1 ft. at the maximum speed, 30 oscillations per min. would be obtained. A standard type of hand-control valve is also fitted which enables the hoist to be fully raised or lowered in the usual manner. Changeover from hand control to automatic oscillation is obtained by a chain-operated selector valve. The hoists are available with double-eyebolt mounting, or with the normal range of 4-wheel articulated trolley sets. The range includes models catering for loads of from 120 to 500 lb. with lifts of 6 ft., and for 120 lb. and 300 lb. loads there are alternative lifts of 10 ft.

Special Greases

A range of heat-resisting, water-repellent, non-melting industrial lubricants, a new rubber lubricant and a brake-servo grease, known as the Molytone family of greases, is now being launched by Rocol, Limited, Swillington, near Leeds, in the United Kingdom, Europe, the Commonwealth and Latin America. They are based on Bentone greases containing molybdenum disulphide.

For the Molytone grade it is claimed that the temperature-resistance enables machinery to be operated continuously at as high a temperature as 230 deg. C. and for short periods at even higher temperatures. The L.M. grade, containing a higher modybdenum-disulphide content is designed for the lubrication of gas cocks, plugs and valves, particularly where much heat is experienced. It has, it is claimed, many applications as an antiseize grease, particularly where sealing at high temperatures is required. It can be used for the prevention of freezing and fretting of static parts fitted together or under semi-static conditions.

Equipment and Supplies

Corebox Turnover Unit

In response to an enquiry from F. H. Lloyd & Company, Limited, steelfounders, to produce a device to speed production in their Wednesbury foundry, the automation division of the Hymatic Engineering Company, Limited, designed an ingenious turnover unit which should have considerable general application in foundries (see Fig. 3). The problem was to turn over a corebox containing rammed-up sand on to a core-plate ready for stripping. The box might weigh up to one ton and a controlled turnover was essential to avoid cracking the core. Previously, an overhead sling had been employed, with a number of men taking the weight; this method was slow and involved the risk of damaging the core by jolting the box and of injuring the men. The turnover device produced by Hymatic provides a controlled inversion of the box on to the plate with no danger of jolting. It is operated by one man and it is claimed that the operation takes only ½ to 1 min., according to conditions. The main components of the device are two L-shaped rocker-arms situated on a low-level roller-conveyor layout. The operator rolls a corebox on to the right-hand rocker and a core-plate on to the left-hand cradle. In the outward position the horizontal arm of each rocker contains rollers which enables this to be done easily. The left-hand rocker is turned inwards, bringing the core-plate to an almost vertical position, the base being prevented from sliding by a retractable steady-bar, notched to accommodate varying thicknesses of plate. The right-hand rocker is then turned inward, turning the corebox through 90 deg. until it faces the core-plate; the inner arms of the two rockers interlace, and a narrow row of rollers in the right-hand rocker allows the operator to move a shallow corebox across to the plate before the next operation of turning the left-hand rocker outwards, which carries both plate and corebox on to the left-hand conveyor. The right-hand rocker is returned empty to accept the next corebox approaching from that side.

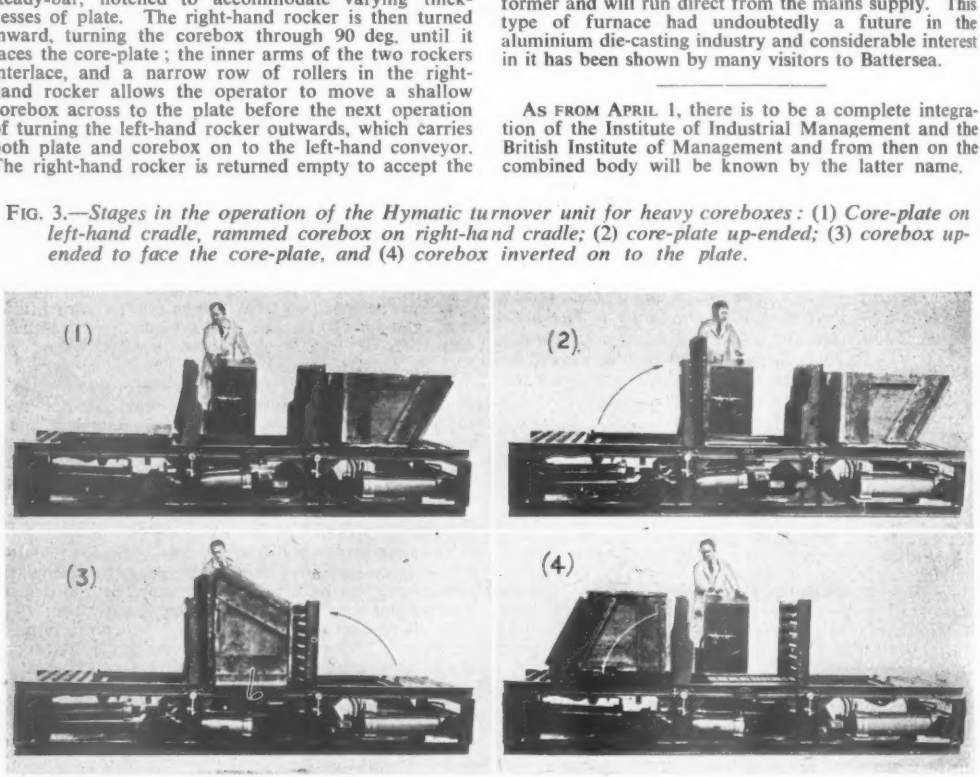
Each rocker is actuated by an air-cylinder arranged horizontally within the frame and coupled to a similar oil-filled cylinder which acts as a speed control. The cylinder spindles, glands and bearing sleeves are protected by gaiters from damage by sand. Control of the device is by two hand levers mounted on a pedestal beside the track; they have a central "off" position which can be recovered by a spring return device. The oil-filled cylinders ensure controlled movement of the rockers and, as a further precaution, cam-operated pilot-valves exhaust the air-cylinders just before the rockers come on to their stops. The turnover unit supplied to F. H. Lloyd, Limited, is being used for coreboxes up to 5 ft. wide and 3 ft. deep (with the core-plate). Other sizes can be produced as required.

Bale-out Furnace

Recently shown to the technical Press at the Morgan Crucible Company's Battersea (London) test foundry is an electric-resistance bale-out furnace, 300 lb. Al capacity. This furnace is an experimental type which is expected to be in production by the middle of the year. It is intended as a maintaining furnace only and is still undergoing extensive tests of crucible and furnace component life. The metal-bath temperature is automatically controlled, the immersed thermocouple being protected by a composite silicon-carbide/mullite sheath. For experimental purposes the furnace is being run from a transformer having variable voltage tappings but the production furnace will not require a transformer and will run direct from the mains supply. This type of furnace had undoubtedly a future in the aluminium die-casting industry and considerable interest in it has been shown by many visitors to Battersea.

AS FROM APRIL 1, there is to be a complete integration of the Institute of Industrial Management and the British Institute of Management and from then on the combined body will be known by the latter name.

FIG. 3.—*Stages in the operation of the Hymatic turnover unit for heavy coreboxes:* (1) *Core-plate on left-hand cradle, rammed corebox on right-hand cradle;* (2) *core-plate up-ended;* (3) *corebox up-ended to face the core-plate, and* (4) *corebox inverted on to the plate.*



Negligence of Fellow Servants—Important Rulings by the House of Lords

By "Barrister-at-Law"

Important principles as to the standard of care which the law expects from employers and workmen, and as to the tests of contributory negligence have been laid down by the House of Lords in the recent case of Staveley Iron & Chemical Company, Limited, *v.* Jones 1956. 1. A.E.R. 403.

In this case a workman was employed in a foundry, and was engaged in assisting in the lifting of a load in an iron pan by an overhead crane. The crane had a main hook from which hung four chains, and it was important that this main hook should be centred over the load to be lifted, since otherwise it was likely to swing out. On the occasion in question the workman was standing at the side of the pan, so that his centering of the hook could not be very accurate. The crane was being operated by a fellow employee. The crane operator should have paused before lifting the load, but he did not do so, and began to lift the load without making certain that the hook was centred and was hanging vertically. The load swung out and the workman was injured.

In the court of first instance, the view was expressed that in considering questions of negligence where workmen are working as it were in a team, as in this case, the standard of care was not as great, as in ordinary cases. The House of Lords refused to accept any such doctrine. In their view there was no reason for applying a specially lenient standard of conduct in such cases where workmen were collaborating together. Therefore, in considering whether there had been negligence in this case, one was to expect that degree of care which an ordinary prudent crane driver would have shown in the circumstances. To put the matter in another way. The House of Lords refused to accept as a principle that conduct which would amount to negligence if a stranger were injured, *might* not amount to negligence if a fellow servant was injured.

The abolition of the doctrine of common employment (under which formerly a master was not responsible to his employee for the negligence of a fellow employee where both employees were engaged together at the time on a common job, the "common employment") made it necessary to hold that the test of negligence was the same whether the person injured was a fellow servant or a stranger. To hold otherwise would mean that, if a servant causes damage, then, by reason of their common employment a fellow servant would not have as full a remedy against his master as a stranger would have. Further, in the view of the House the standard of care could not vary according as to whether the case was one in which the injured person was suing the workman directly for negligence, or one in which the injured person was suing the employer of the workman for the latter's negligence, the employer's liability in such a case being of a vicarious nature.

Contributory Negligence

When one comes to consider the question of contributory negligence, it would appear that some variation of the standard of care becomes necessary. Contributory negligence arises where a person who is injured by the negligence of another is met by the defence that he himself was negligent and thus contributed to the injury. Where a statute, such as the Factory Acts, imposes obligations on an employer, then the employer, if an accident has occurred as the result of a breach by him of his statutory duty, will not be entitled to expect so high a standard of care from the injured employee as might be required from the employee if the latter was being sued for negligence by a third party. Thus it will not be every risky act which the injured employee does, due to familiarity with the work, or every inattention on his part resulting from noise or strain, which will amount to contributory negligence on his part, so that the employer will notwithstanding be liable to the injured employee for his, the employer's, breach of statutory duty. But the same acts or omissions on the part of the injured employee, which would not constitute contributory negligence, might well constitute negligence on his part sufficient to entitle a third party, who was injured in consequence, to sue him and also his employer for his negligence.

The reason for the relaxation of the standard in cases where the employer in breach of statutory duty seeks to allege contributory negligence on the part of the employee, in answer to the latter's claim against him, is that the whole object of the Factories Acts in imposing these statutory obligations on employers is to protect the workmen against those very acts of inattention which are sometimes relied on as constituting contributory negligence, so that too strict a standard of care on the part of the workmen would defeat the object of the statute.

In this case the court held that the crane driver had negligently handled the crane but that no contributory negligence had been established on the part of the injured workman, since his conduct did not fall short of the standard required from a reasonably careful workman assisting in such an operation and that accordingly the injured workman was entitled to damages in full against the employer.

METAL INDUSTRIES, LIMITED—The board is now constituted:—Sir Charles Westlake (chairman), Mr. J. Black, Mr. J. O. Knowles, Mr. J. T. Rymer, Mr. J. R. Twaddle, and Mr. W. H. Garrett.

SPEAR & JACKSON, LIMITED—Mr. R. J. Coombe has been appointed a director and Mr. J. Williamson and Mr. G. R. A. Wilson have become special directors. Mr. H. Broadbent has retired from the board.

Company News

FOLLSAIN-WYCLIFFE FOUNDRIES, LIMITED—CIC consent has been obtained for the issue of £25,000 fresh capital. New ordinary shares will be offered to shareholders in proportion to their present holdings. The price at which the shares will be offered has not yet been decided, but shareholders will be notified at an early date.

JOHN SUMMERS & SONS, LIMITED—Group profit expanded from £8,674,289 to £9,443,033 in the year ended September 29, 1956. After increased depreciation and taxation charges, the net balance is £127,208 lower at £2,770,601. The dividend on the £9,000,000 ordinary capital is maintained at 12 per cent. less tax, with an unchanged final of 8 per cent.

PEASE & PARTNERS, LIMITED—The directors announce the sale of the share capital of the company's wholly owned subsidiary, Deepwater Wharf, Limited, to T. Roddam Dent & Son, Limited, which will operate the wharf with its other Tees-side properties. The capital loss incurred in the sale has been covered by the balance standing to the credit of the share premium account.

FLETCHER, HOUSTON & COMPANY, LIMITED, ironfounders, engineers, etc., of Dudley Port, Tipton (Staffs)—Despite the acute recession in the motor-car industry, the variety of work produced enabled the company to maintain a level of output comparable to that of the previous year. Announcing the acquisition of Joseph Billingham (Ships Tackle) Company, Limited, Mr. W. West, chairman, says the board is widening the scope of business activities in the hope of offsetting the present general adverse circumstances. Group net profit, before tax of £80,150 (£52,904) for the year to September 30, 1956, rose from £108,933 to £153,496, which included the recently acquired F. & W. Thornton, Limited, for 13 months. The dividend is 60 per cent. (same) on £76,000 (£47,500) capital as raised by a three-for-five rights issue.

ASSOCIATED ENGINEERING HOLDINGS, LIMITED—The recession in the motor industry led to a falling off in the high level of activity with which the year started and turnover for this side of the business was about the same as for 1955. Elsewhere turnover showed a substantial increase and, in the aggregate, expanded by 13 per cent. A capital programme of about £3,400,000 has been approved; commitments to date amount to £1,335,000 and of the balance £1,100,000 is in respect of schemes authorized but not yet started. The intention is to finance the programme from liquid resources and future retained profits. Profit is £2,253,311 (£2,084,328) before tax and the dividend 20 per cent. The board recommends that the deputy chairman, Mr. H. R. Moore, be appointed chairman as from January 31. Mr. A. H. Jarrard (chairman) and Mr. J. W. Howlett do not seek re-election to the board and it is not intended for the present to fill the vacancies.

REDPATH, BROWN & COMPANY, LIMITED—Presiding at the annual meeting in Edinburgh on January 9, Sir Ellis Hunter, the chairman, drew attention to the fact that the meeting marked the diamond jubilee of the incorporation of the company as a public limited liability company, although, of course, it had been a continuing and successful business since 1802. He said the restriction of credit had caused the postponement of several important projects, some of them perhaps indefinitely. Steel supplies had again been restricted and this had been particularly apparent in the more common sizes of sections. A feature of the year's operations was the increase in the total level of output; but it was noteworthy that although the gross output had risen by 8 per cent., aggregate wages had risen by 9½ per cent. The tonnage of orders on hand at the end of the financial year was satisfactory, being 36 per cent. higher than a year ago. There was nine to 12 months' work at full capacity for all the branches.

THOS. FIRTH & JOHN BROWN, LIMITED—In relation to output the year's profit margin was lower, but throughout the year nearly all the plant was operated at full capacity and sales, both volume and turnover, were above the previous year. The group spent £990,116 on capital account and construction of the light forge, the light and medium heat-treatment departments and the gas-producer plant were completed and in full operation. An extension to the heavy machine shops was completed and, this year, it is expected that the new 1,750 forge will be operating. Projects in hand include a new 800-ton forging press and additions to the coggin mill capacity are expected to increase output of billets by 30 per cent. Commitments entered into amount to £1,107,000 and schemes approved but not yet begun involve over £2,500,000.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

ABERDARE, January 26—Manhole and inspection frames and covers; gully gratings and frames; small tools, etc., for the year ending March 31, 1958, for the Urban District Council. The Engineer and Surveyor, Vestry Hall, Aberdare.

BEDLINGTON, February 16—Iron castings, tools, cast-iron rainwater goods, copper fittings, steel reinforcement, copper tube, etc., for the 12 months ending March 31, 1958, for the Bedlingtonshire Urban District Council. Mr. A. K. Dennis, Engineer and Surveyor, Council Offices, Bedlington (Northumberland).

BOURNEMOUTH, February 1—Manhole covers and frames, etc., for the year ending March 31, 1958, for the Town Council. The Borough Engineer, Town Hall, Bournemouth.

DURHAM, February 8—Cast-iron gullies, manhole covers, and frames for the year ending March 31, 1958, for the County Council. The County Engineer and Surveyor, Aykley Heads, Durham.

GILLINGHAM, January 21—Cast manhole covers and road gully gratings and frames; rainwater goods; tools, etc., for 12 months from April 1, for the Borough Engineer's Department. The Borough Engineer, Municipal Buildings, Gillingham (Kent).

HAVERFORDWEST, January 29—Cast-iron gully gratings and frames, manhole and footpath covers, etc., for the year ending March 31, 1958, for the Pembrokeshire County Council. Mr. W. Brundan, County Surveyor, County Offices, Haverfordwest.

HEREFORD, February 11—Iron castings for 12 months from April 1, for the City Council. Mr. F. Margerison, City Surveyor, Town Hall, Hereford.

HUDDERSFIELD, January 28—Cast-iron materials, electric cables, etc., for the 12 months ending March 31, 1956, for the Corporation. The Borough Engineer and Surveyor, High Street Buildings, Huddersfield.

IRAQ, February 2—Valves and pipes, for the Ministry of Interior, Directorate General of Municipalities. (ESB/363/57.)

NORTHALLERTON, January 21—Cast-iron manhole covers, etc.; tubular steel gates and gate posts, etc., for the year ending March 31, 1958, for the North Riding County Council. The County Surveyor, County Hall, Northallerton (Yorks).

PAKISTAN, January 23—Centrifugal pump, for the Director-General of Supply and Development, Karachi. (ESB/613/57/ICA.)

PAKISTAN, January 29—Machine tools, etc., for the Director General of Supply and Development. (ESB/32592/56/ICA.)

PAKISTAN, January 30—Machine tools, for the Director-General of Supply and Development, Karachi. (ESB/32586/56/ICA.)

PETERBOROUGH, January 31—Cast-iron gully grates and frames and manhole covers and frames; galvanized manhole step irons, for the City Council. Mr. L. H. Robjohn, City Engineer and Surveyor, Town Hall, Peterborough.

News in Brief

ROBERT JENKINS & COMPANY, LIMITED, of Rotherham, held their annual staff dance at the Rotherham Town Hall on January 4.

FIRTH-VICKERS STAINLESS STEELS, LIMITED, of Sheffield, have presented to Sheffield Cathedral, two stainless-steel altar vases for the sanctuary.

THE NAME of Stourvale Products, Limited, ironfounders, Banners Lane, Cradley, Staffs, has been changed to James Oakley & Sons, Limited.

MOXEY CONVEYOR & TRANSPORTER COMPANY, LIMITED, of Birmingham, announce that on January 1, the name of the company was changed to Moxey, Limited.

THE AUTUMN MEETING of the Institute of Metals will be held in Glasgow from Tuesday to Friday, September 17 to 20, by invitation of the Scottish local section.

Mr. J. S. TURNBULL, of the works development unit of Metropolitan-Vickers Company, spoke on precision castings to members of Motherwell & Wishaw Electrical & Mechanical Society last week.

LADY WILLIAM PATERSON has presented a portrait of her late husband to the Heriot-Watt College in Edinburgh. Sir William, of Soho Foundry fame, commissioned the portrait when he was 80.

WOLF ELECTRIC TOOLS, LIMITED, announce that they have moved their service department to Newlon Works, Stanlake Road, Shepherds Bush, London, W.12. The department is under the control of Mr. C. S. Butcher.

A BID from the English Electric Company, Limited, of $415,854 (about £150,000) was the apparent lowest for a three-phase auto transformer for a St. Lawrence Seaway project, announces the New York State Power Authority.

BECAUSE of a trade depression the Southern Ireland firm, Waterford Ironfounders, Limited, have introduced short-time working. Ninety employees are affected by the decision which reduces operations in the foundry to three days a week.

Mr. J. PRICE, sales manager of Pollard Bearings, Limited, is making an extended tour of Canada and USA visiting agents, distributors and important users there. Their new factory near Toronto is scheduled to open in late Spring.

AN EXPENDITURE of about £1,000,000 has been authorized by Richardsons, Westgarth & Company, Limited, for extensions at its West Hartlepool works, chiefly for the production of large-sized turbo-alternators sets and the provision of equipment for power stations.

THE Minister of Housing and Local Government has agreed that 100 acres of land at Hopton, near Wirksworth, may be used for the quarrying of dolomite. This will involve the erection of a processing plant, and the necessary houses for key workers.

THE BELFAST BRANCH OFFICE of Honeywell-Brown Limited, has moved to larger premises at 296, Albert Bridge Road, Belfast. The new office is equipped to deal with all enquiries for industrial instrumentation, heating and air conditioning controls, and precision switches.

MR. H. G. HILTON, president of the company, has announced that the Steel Company of Canada, Limited, last year increased its basic steel production by 15 per cent. Canada's biggest steel producer, the company made 2,367,000 ingot tons, which is 307,000 tons more than 1955's record.

DESCRIBED AS THE LARGEST MERCHANT SHIP in the world to be powered by a free-piston gas-turbine, installation has been ordered from Lithgows Limited, Port Glasgow, and Rankin & Blackmore Limited, engineers, Greenock, by the Crest Shipping Company Limited, Nassau, Bahamas.

The NON-DESTRUCTIVE TESTING GROUP of the Institute of Physics will hold a meeting on Friday, January 18, at 6.30 p.m., in the lecture room of the Institute's House at 47, Belgrave Square, London, S.W.1. when Mr. E. E. Smith will speak on "Radiological Protection—the Present View."

NEW OFFICES at 44, Hertford Street, London, W.1 (telephone GROSVENOR 1402-3), have been opened by Pollard Bearings, Limited, Ferrybridge (Yorks), and the Philidas division of Whitehouse Industries, Limited, also of Ferrybridge, which makes "Philidas" lock nuts for the aircraft and engineering industries.

A NEW private company, designated Systematic Tooling, Limited, has been formed to acquire the capitals of J. B. Purefoy Unit Tooling, Limited, and Shepherd's Aerosols, Limited, and the whole or part of the undertaking of the Purefoy Engineering Company, Limited. The new company's authorized capital is £500,000.

THE Darnall ironfoundry and equipment were sold by auction for the Davy & United Engineering Company, Limited, Sheffield, last week. The foundry is no longer required because the company's rolling mills use steel or fabricated parts instead of cast iron. Foundry-workers are being placed with other firms or found work in other departments.

A FREE-PISTON gas generator turbine of 4,000 h.p. is to be fitted in place of the 3,690-h.p. triple-expansion engine in the British India Steam Navigation Company's 5,417-ton vessel, Ormara, by Alexander Stephen & Sons, Limited, Glasgow. The company is the third firm of British shipbuilders to be licensed to construct Pescara free-piston machinery.

IMPERIAL CHEMICAL INDUSTRIES, LIMITED, has negotiated the purchase of the bulk of Sir Richard Brooke's Norton estate—between Runcorn and Stockton Heath (Ches). The company states that it is not intended immediately to develop the land, which amounts to more than 1,000 acres, but has in mind a long-term scheme of industrial development.

THE SHORTAGE OF INDUSTRIAL OIL has forced the firm of Hopyard Foundries, Limited, Coseley, to go back to the use of pulverized fuel in three of their eleven furnaces, which were recently converted to oil-firing. Anticipating complaints from nearby residents about the resultant smoke and grit, a letter has been sent to them explaining why the reversion is necessary.

A £280,000 CONTRACT for marine diesels has been awarded to the National Gas & Oil Engine Company, Limited, Ashton-under-Lyne, a member of the Brush Group, Limited, by the Polish Government buying agency on behalf of the Polish Ship Salvage Company, Gdynia. The engines will provide the propulsion and auxiliary power for two ocean-going tugs.

THE English Electric Company, Limited, has been awarded a contract to supply seven 750 h.p. diesel-electric locomotives to the Midlands Railways of Western Australia. The engines and electrical equipment for the locomotives will be built at the company's Preston works and the mechanical parts will be manufactured at the Rocklea works in Australia.

THE FLOW OF MATERIALS and supplies for the recently announced $175,000,000 development of the International Nickel Company of Canada, Limited, in Northern Manitoba is now being organized. Pending

News in Brief

construction of the Canadian National Railway branch line, movement of freight to the plant and mine sites will be made by tractor train throughout the winter so that construction may be pushed forward vigorously in the spring.

COCKBURNS LIMITED, GLASGOW, has received its second large dollar order in two months. The contract, valued at more than £12,000 is for turbine control valve equipment for three 32,000-ton Caltex tankers building at Schiedam, Holland. Mr. James Peacock, sales manager, stated that over 20 per cent. of the company's production goes to export, and a substantial proportion earned dollars. Last year overseas orders valued at more than £40,000 had been booked by the end of February, and this was an encouraging start for 1957.

THE IRON AND STEEL INSTITUTE is organizing a meeting of junior engineers—that is below the age of 35—and is to include both members and non-members. It takes the form of visits to the works of John Summers & Sons, Limited, and the Metropolitan-Vickers Electrical Company, Limited, and a lecture on "Engineering Problems in Nuclear Power Stations," by Mr. S. A. Ghalib. The meeting is to be held in Chester from March 11 to 14, and those wishing for further details should write to the secretary of the Institute at 4, Grosvenor Gardens, London, S.W.1.

AT the recent annual prizegiving and exhibition of apprentices' work at George Kent, Limited, Commander Kent, chairman and managing director, presented the following prizes: Commander Kent Challenge Cup: J. C. Keeling; Sir Walter Kent Prize: E. L. Amiss; R. W. Bedford Challenge Cup: R. Stratford; Grout Prize: M. J. Mansbridge. During 1956 the company had 127 apprentices under training, of these 47 received the attendance prize; to qualify for this award it was necessary to maintain 100 per cent. attendance and punctuality at both school and work.

Mr. T. W. MCCULLOUGH, H.M. Deputy Chief Inspector of Factories, addressed 60 members of the Sheffield Area Industrial Group of the Royal Society for the Prevention of Accidents on January 8. He told them, "Trade unions are at last beginning to realize that their responsibilities are not solely confined to securing adequate compensation but to see that their members are educated in preventing accidents from happening." He said he would like more thought to be given to accident prevention in technical schools. This might lead to built-in safety devices for machines at the drawing board stage.

A NEW COMPANY, the Consolidated Pneumatic Tool Company of Central Africa (Pvt.), Limited, has been formed to develop the business of the Consolidated Pneumatic Tool Company, Limited, in the Federation of Rhodesia and Nyasaland. The company, which is one of Britain's largest manufacturers of air compressors and portable power tools, formerly operated through J. Clack & Company (Pvt.), Limited, which will continue its representation in the Salisbury and Ndola territories. The managing director of the new company is Mr. R. G. Wells, who has been associated with the company in Central Africa for over 20 years.

FOLLOWING THE TAKE-OVER of Sagar & Bursgreen machines sales and service departments on January 1, Wadkin Limited of Leicester, announce that their area representatives will be as follows: Yorkshire, Mr. R. Walker; North of the Tees to the Scottish border, Mr. E. N. Dobbie; West Riding, Mr. M. H. Lickness and Mr. J. E. Brearley; Stafford, Shropshire, Hereford and Worcester, Mr. T. R. Groom; South West and South Wales, Mr. E. Hargreaves and Mr. D. H. Westbrook; Eastern Counties, Mr. E. R. Saunders. It is also announced that Mr. P. H. Morris is appointed as technical assistant to the technical director Mr. S. Radcliffe, at the head office in Leicester. The Sagar office in Birmingham will be closed, and the London office is being transferred to the Wadkin London office at 62, Brook Street, W.1.

Obituary

Mr. FRANK WHITELEY, transport and stores manager of Beecroft & Partners (Metallurgists) Limited, Sheffield, has died at the age of 58.

Mr. ROBERT HOWITT, who was manager of the Milnwood iron and steel works, Mossend, of Smith & McLean, Limited, died on January 6.

Mr. ARTHUR CYRIL ANSELL, a director of Wilfred Robbins, Limited, structural engineers, etc., of Tipton (Staffs), died on January 6 at the age of 51.

The death occurred on January 4 of Mr. THOMAS BEARDWOOD ASPIN, a director of F. M. Aspin & Company, Limited, lightweight engine and cutting tool manufacturers, of Elton, Bury.

The death is reported of Mr. GEORGE HENRY ROBINSON, who was chairman of J. H. Robinson & Company (Liverpool), Limited, gas meter manufacturers, etc., and a director of Smith Meters, Limited, London, S.E.11, the Sunderland Meter Company, Limited, United Gas Industries, Limited, London, W.C.2, the Vulcan Stove Company, Limited, Exeter, and Willey & Company, Limited, gas engineers, etc., of Exeter.

Recent Wills

DAVIES, A. S., chief buyer of the Guest Keen Iron & Steel Company, Limited, Cardiff £48,517

SCHOFIELD, E. R., a director of Alfred Herbert, Limited, machine-tool makers, etc., of Coventry... £49,407

BAKER, B. D., vice-chairman of Baker Perkins, Limited, manufacturing engineers, etc., of Peterborough £10,642

MOORE-EDE, S. S., a director of Johnson, Matthey & Company, Limited, assayers and refiners of precious metals, of Hatton Garden, London, E.C.1 ... ... £100,528

JAMES J. R. D., sales director of Harrison (Birmingham), Limited, brassfounders, metal rollers, etc. £76,790

BINKS, C. L., a director and general manager of Amal, Limited, manufacturers of motor-cycle, car, and aircraft components, etc., of Birmingham £18,649

PATRICKSON, W. E. S., of Brookhouse, Caton (Lancs), formerly for many years chairman of B. Huntsman, Limited, steelmakers, of Attercliffe, Sheffield, and late chairman of John Cooper & Son, Limited, toolmakers, etc., of Sheffield ... £11,095

VIVIAN, CAPT. HUGH, late a director of Associated Electrical Industries, Limited, Paterson Engineering Company, Limited, and other companies, chairman of Beyer, Peacock & Company, Limited, locomotive builders, etc., of Gorton, Manchester, and part-time director of the South-Western Divisional Coal Board £55,444

Changes of Name

Among companies which have recently changed their names are those listed below. The new titles are given in parentheses.

GENERAL BRIGHT STEEL & BOLT COMPANY, LIMITED, Springfield Road, Hayes, Middx (General Machining Company, Limited).

GRADES SHEARED METAL COMPANY, LIMITED, Room 139, Temple Chambers, Temple Avenue, London, E.C.4 (Grades Metals, Limited).

Personal

Mr. R. H. BATCHELOR has resigned from the board of Vauxhall Motors Limited.

Mr. ALICK S. DICK and Mr. KENNETH ASPLAND have been appointed directors of Beans Industries, Limited.

Mr. D. MURRAY has been appointed assistant traffic adviser to the British Transport Commission, British Railways.

British Insulated Callender's Cables, Limited, announce the appointment of Mr. C. MURRAY, B.SC., (ENG.), A.M.I.E.E., to be manager (overseas).

Mr. ERIC L. BACHE, M.C., LL.B., has been appointed chairman of the board of George Salter & Company, Limited, of West Bromwich. He succeeds his brother, the late Mr. C. S. BACHE.

Mr. H. F. TREMLETT has been appointed as deputy director of the British Welding Research Association, he will take up his appointment on February 1, at the Abington Research Station.

Mr. R. MCKINNON WOOD, who is to be the chairman of the London County Council, is the chairman of Griffin & George, Limited, laboratory furnishers and scientific instrument makers.

It is announced by the Ministry of Supply that Mr. E. E. HADDON has been appointed Director of Chemical Defence Research and Development in succession to Mr. A. E. CHILDS, who retired on January 16.

To mark the completion of 50 years' service with Herbert Morris, Limited, of Loughborough, Mr. GEORGE HOLLINGWORTH, foreman mill-wright, was presented with a television set by Mr. F. MORRIS, chairman and managing director.

Dr. M. L. BECKER has relinquished his position as head of the metallurgical division of the British Iron and Steel Research Association, and is now technical director of the Chrome Alloying Company, Limited, Hatfield, and of Diffusion Alloys, Limited, London Bridge House, London, S.E.1.

Dr. W. I. PUMPHREY, PH.D., M.SC., research manager of Murex Welding Processes, Limited, Waltham Cross, has been awarded the degree of D.SC. in industrial metallurgy by the University of Birmingham for his work on hardenability, the transformation of steel during continuous cooling and the metallurgy of welding.

Mr. SIDNEY GOODWIN has retired after 25 years' service with Qualcast, Limited, Derby, where he held the position of sheet-metal department foreman. At a social at the King's Hall, Derby, he was presented with a silver cigarette box, and a cheque from Mr. D. A. MACMILLAN, joint assistant managing director, as a memento of the occasion.

Mr. H. W. PARTRIDGE who has retired from service with the Brush Electrical Engineering Company, Limited, after 51 years', was presented with a number of gifts of furniture by the managing director, Mr. M. TATTERSFIELD. Mr. Partridge, who was apprentice supervisor, received other gifts from the apprentices' association, presented by the chairman, Mr. B. J. POWELL.

Mr. W. POWELL, who has been actively associated with the ferro-manganese industry in technical, commercial, and administrative capacities for 40 years, has retired from the Darwen & Mostyn Iron Company, Limited, Mostyn, Holywell (Flintshire). He was appointed commercial director in 1951 and was also company secretary. He was also for a time vice-president of the Industrial Association of Wales and Monmouthshire.

Mr. C. B. NIXON, having attained the age of 80, has decided to retire from the chairmanship of the Leyland group, but will retain his seat on the board. He is succeeded as chairman by Sir HENRY SPURRIER, who retains his present office of managing director. Mr. WALTER WEST, deputy managing director, becomes deputy chairman, and Mr. W. E. PEARSON, managing director of Scammell Lorries, Limited, has been appointed to a seat on the parent board.

Mr. D. RIDER has resigned as joint managing director and retired from the board of Woodall-Duckham Construction Company, Limited, in accordance with the retirement rules of the company. He retains his directorship of the parent company Woodall-Duckham, Limited. Mr. F. P. DYSON has been appointed joint managing director of the Woodall-Duckham Construction Company and Mr. C. D. MUNTZ and Mr. E. N. WENBORN have been appointed directors.

Mr. W. C. F. HESSENBERG, M.A., F.I.M., deputy director of the British Iron and Steel Research Association, has been elected a member of the Council of the Iron and Steel Institute. He joined BISRA in 1947 as head of the mechanical working division, and was appointed deputy director in 1951. His previous experience, after graduation, was gained with Enfield Cable Works, Limited, Enfield Rolling Mills, Limited, and the British Non-Ferrous Metals Research Association.

British Transport Commission announce the appointment of Mr. G. H. HINDS, O.B.E. (formerly Director of Weapons Research, Ministry of Supply), as Electronics Advisory Officer, BTC. The appointments of Mr. Hinds, and of an Electronics Advisory Panel of BTC officers in conjunction with whom he will work, have been made in order to foster progress of this nature throughout the Commission's undertakings, and to keep abreast of electronic research and developments elsewhere.

After an association of more than half a century (53 years to be precise) Mr. ARTHUR DORMAN, who is 75, is to retire this month from Dorman Long & Company, Limited. He is the youngest and sole surviving son of the late Sir Arthur Dorman and he served as president of the Iron and Steel Institute from 1944 to 1946. He is also a past-president of the British Iron and Steel Federation, while in 1953 he succeeded Major W. R. Brown as president of the Cleveland Scientific and Technical Institute.

Mr. J. D. PEARSON, who is 48, has taken over from Lord Hives as chief executive of Rolls-Royce, Limited. Lord Hives, who joined the company in 1908 as a mechanic, has retired as chairman and chief executive on reaching the age of 70. Mr. PEARSON and Mr. WHITNEY STRAIGHT, former deputy chairman of British Overseas Airways Corporation, become deputy chairmen of the board, while Lord KINDERSLEY, a member of the Court of the Bank of England, succeeds Lord Hives as chairman of Rolls-Royce.

Mr. H. S. MALIK, lately Indian Ambassador to France, has been appointed a special director (India) of Simon-Carves, Limited. He will be resident in Delhi where he arrived early this month. Mr. Malik entered the Indian Civil Service in 1922 and from then until 1944 held numerous home and overseas appointments. He was Prime Minister of Patiala State from 1944 to 1947 and, when India achieved independence in 1947, he became the first Indian High Commissioner in Canada. In 1949, he was appointed the first Indian Ambassador to France.

Publications Received

Economic and Commercial Conditions in Greece (Overseas Economic Survey), by F. C. Mason. Published for the Board of Trade by Her Majesty's Stationery Office, York House, Kingsway, London, W.C.2; price 4s. 6d. net.

In his introduction, Mr. Mason reviews the post-war conditions in Greece, and points out that in recent times the market has been expanded, and indeed trade with this country is greater than that with either Turkey or Jugoslavia, and now approximates two-thirds that of the trade done with Spain, USSR, or Switzerland. The foundry industry is lumped in with iron and steel, and the information is given that "There are also two small factories for making special cast steel and steel alloys"—which might or might not indicate foundries. Other useful information given is that "six firms (all in Athens) manufacture small iron pipes" (presumably rainwater goods—Editor), "and their production is steadily increasing due to the large amount of building at present being carried out." "The number of foundries in Greece is listed at 80, and their products are mostly iron castings." As American aid seems likely favourably to affect Greek economy for the next five years or so, the quicker UK firms can enter the market the better.

Industrial Engineering. Issued by the Industrial Engineering Department, Loughborough College of Technology, Loughborough.

This 48-page pamphlet gives the syllabuses for both a "sandwich" and a post-graduate course. The former covers both industrial administration and production engineering, whilst the latter is confined to the first-named subject. It would appear to the reviewer, that once a student has successfully got over the first two years, the subjects become easier of assimilation; in fact it is truthful to state that in the old days, knowledge of the subjects taught in the fifth year had to be picked up after one started working. Then, after graduation, one was probably told that if the training received indicated what was to be learnt, that was the object of the course. To-day all that is changing, and for the better, providing that no instruction time is wasted in pouring out platitudes. The reviewer is not at all sure that this course would answer the requirements of the Dip. Tech. award, as it is too technical too early, but it should turn out first-class departmental heads—after a few years experience. It is a course of a general-engineering and metallurgical character, which should give the student a broad basis, from which he can subsequently specialize.

Nickel Plating for Engineers. Issued by the Mond Nickel Company, Limited, Thames House, Millbank, London, S.W.1.

As its title implies, this brochure has been written primarily for engineers, designers and others who are interested in the possibilities which plating offers in design. No attempt has been made to cover plating procedures in great detail, but practices have been dealt with in so far as they affect the properties of the resultant deposits. The text includes a description of surface preparation in general and for zinc-base alloys, aluminium and nickel/chromium/iron alloys in particular. Commonly used solutions, relevant plating procedures to maintain high quality work, plant required, mechanical properties of deposits and methods of testing deposits are all dealt with in a highly compressed text. For quick reference, a good deal of information is given in the form of graphs or tables. Copies of the publication are obtainable free of charge on writing to Thames House.

Three Years of LD Steel, Vöest 1953-1956. Published by the A. G. Linz concern in Austria.

This well-produced brochure details the developments resulting from the use of an oxygen blow in steelmaking. It is a process which is rapidly expanding in British steelworks. In Austria, the system has made economically possible the use of native ores. The process in that country has been named LD, but the significance of this title is not clear to the reviewer.

Coal: the Price Structure (3rd Edition). Published by the Federation of British Industries, 21, Tothill Street, London, S.W.1; price 2s.

As the law of supply and demand no longer governs the price of any type of coal, a schedule has been worked out which takes into consideration the BTU's, the ash-content, cost of preparation and other factors. These factors are set out and brought up to date in this the third edition of a useful booklet.

House Organs

Albion Works Bulletin, Vol. 10, No. 3; issued by John Harper & Company, Limited, Willenhall, Staffs.

This issue reports the retirement of Mr. Charles Bennett, after 40 years' service, much of which was spent as a foreman moulder, but for the last nine years as apprentices' master. He received from his colleagues a gold wristlet watch as a parting gift. A message from Mr. Wilfred Harper recalls that it is 165 years since William Harper, his great-great-great grandfather, founded the company, which now employs over 1,400 people.

The Stantonian, Vol. 20, No. 4; published by the Stanton Ironworks Company, Limited, near Nottingham.

This issue contains an interesting account of the visit made by a number of the firm's apprentices to Germany, where several metallurgical plants were inspected. The trip included a visit to the International Foundry Exhibition at Düsseldorf. There is a full account of the awards gained in the various national examinations by Stanton apprentices, and it is pleasing to report that they have done particularly well.

Platinum Metals Review, Vol. 1, No. 1; published by Johnson, Matthey & Company, Limited, 78, Hatton Garden, London, E.C.1.

This new magazine, which is to be published quarterly, is a welcome newcomer to the ever-increasing number of technical house organs. Most of the literature of the platinum range of metals is of the type prepared for presentation to the learned societies, but here there is available, in a well-produced magazine, reliable information couched in terms which the layman can appreciate and assimilate. It is an extremely interesting, 36-page, well-illustrated magazine.

Lab Mail (November); issued by Glen Creston, Limited, 41, Church Road, Stanmore, Middx.

This publication is wholly taken up by advertisements for laboratory instruments and requisites. Some of these refer to novelties, such as a siphoning starter which, at the moment, should be in good demand by the less-scrupulous section of the population, for a purpose unknown a few years ago. The publication is available to readers on writing to Stanmore.

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Raw Material Markets

Iron and Steel

Supplies of raw materials for the blast furnaces are on a good scale. Although imports of iron ore fell in November, the yearly total exceeded the 1955 figures by an appreciable quantity. Deliveries of blast-furnace coke kept up remarkably well during last year, much better than was expected in view of the shortage of coking coal and coke-oven capacity. Occasional complaints arise of the inferior quality of coke.

The main demand for pig-iron continues to come from the steelworks, and outputs of basic steelmaking pig-iron are disposed of readily. New steel production capacity is due to come into operation this year, and it is expected that this will increase the present yearly outputs by about 1,500,000 tons, provided, of course, that the required fuel is available. This will necessitate the supply of an increased quantity of basic pig-iron and new furnaces will come into production later. Demands for the foundry grades of pig-iron are generally on a much lighter scale. Owing to the uncertainty of business in some trades, the foundries are hesitant in the purchasing of pig-iron. The foundries supplying castings to the motor vehicle trades have fluctuating demands and business is not sufficient to keep them in full operation. Many of the other general engineering and speciality foundries are busy. Good tonnages of the low-phosphorus irons and hematite are being used by these foundries. Efforts are being made by producers of the high-phosphorus irons to clear off orders on their books. Many of the light foundries are still short of work, while business at the textile foundries is slack. The jobbing foundries are faring a little better.

The re-rollers are taking up all available supplies of steel semis, and tonnages from home steelworks are coming forward regularly. Heavier demands continue to be made as stocks become lower due to reduced imports, with the result that a large proportion of current deliveries go into immediate production, particularly in the smaller sizes of billets. Pressure is sustained on home steelworks for these smaller sizes of 2 in. and 2¼ in. as well as for carbon and alloy steels.

The re-rollers continue to be well employed, with home demands for small bars and light sections at a good level. Although pressure for supplies is not so heavy as it was, enough work is on hand to ensure good outputs, coupled with the business on hand for overseas markets.

Non-ferrous Metals

Quiet conditions continue in the non-ferrous metal markets on both sides of the Atlantic. Demand for copper in London is modest, inquiry from the Continent is negligible, and with supplies adequate the backwardation is closing. Under these influences and the strength of sterling the price continues to shade to lower levels. There is nothing in prospect to reverse this easier trend. Moreover, it is to be remembered that there are some 7,000 tons of copper metal coming on to the market from Government sources each month and, in addition, tenders are due in the middle of this month to the Board of Trade for approximately 4,800 tons of copper—mainly in the form of cathodes. In the US the market is featureless. Producers are still quoting 36 cents and custom smelters 35 cents, while export copper is priced at 34½ cents and scrap is being offered at 28 cents per pound. Export business with Japan has fallen to a low ebb.

Some interest has been imparted to the lead and the zinc markets because of the strike on the Canadian Pacific Railway. This has curtailed supplies of both metals as, among others, Canada's largest producer, Consolidating Mining & Smelting, has been compelled to close because it obtains its concentrates from Kimberley, British Columbia, via the CPR. The repercussions by the end of last week had travelled as far as the London Metal Exchange, which helped to maintain prices on the understanding that a continuation of the situation would affect imports of Canadian metal. However, the strike has now been settled so that fears that the prices of both lead and zinc would be raised have now disappeared. Zinc supplies on the other side of the Atlantic are also affected by the strike at American Smelting & Refining's zinc plant at Corpus Christi, which shows no signs of breaking. At present most surplus lead and zinc in Europe have found their way into the US stockpile so that reduced supplies from any of the usual sources is viewed seriously. Evidence of the present tight supply position for zinc in London is seen in the backwardation. Current month delivery zinc touched a four-year peak of £106 a ton in trading on the LME on Tuesday.

In tin, the central item of news is the strike at the Straits Trading Company's Butterworth smelter which began on January 10 after wage negotiations had broken down. However, it has not had any visible affect on the price. Owing to the sale of the Texas smelter Bolivian concentrates will henceforth be shipped to the UK for treatment. In America activity is light and the price continues to hover about the $1.00 per pound level.

Effect of Petrol Rationing on BIF

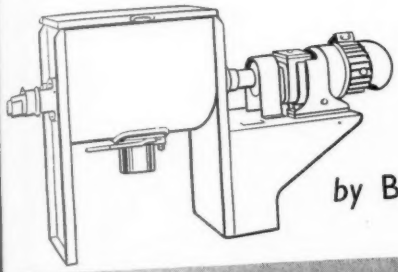
Mr. E. M. Clayson, chairman of the British Industries Fair executive committee, said on January 10, that it was feared that exhibitors' staff would be prevented by lack of petrol from travelling between the fair and the out-of-town hotels where many of them stayed. Bookings amounted to only 53 per cent. of last year's total, compared with the usual level of 65 to 70 per cent. four months before the fair opened.

The Birmingham Chamber of Commerce is making the strongest possible representations to the Ministry of Fuel for a special allocation of petrol for exhibitors.

Acknowledged with Thanks

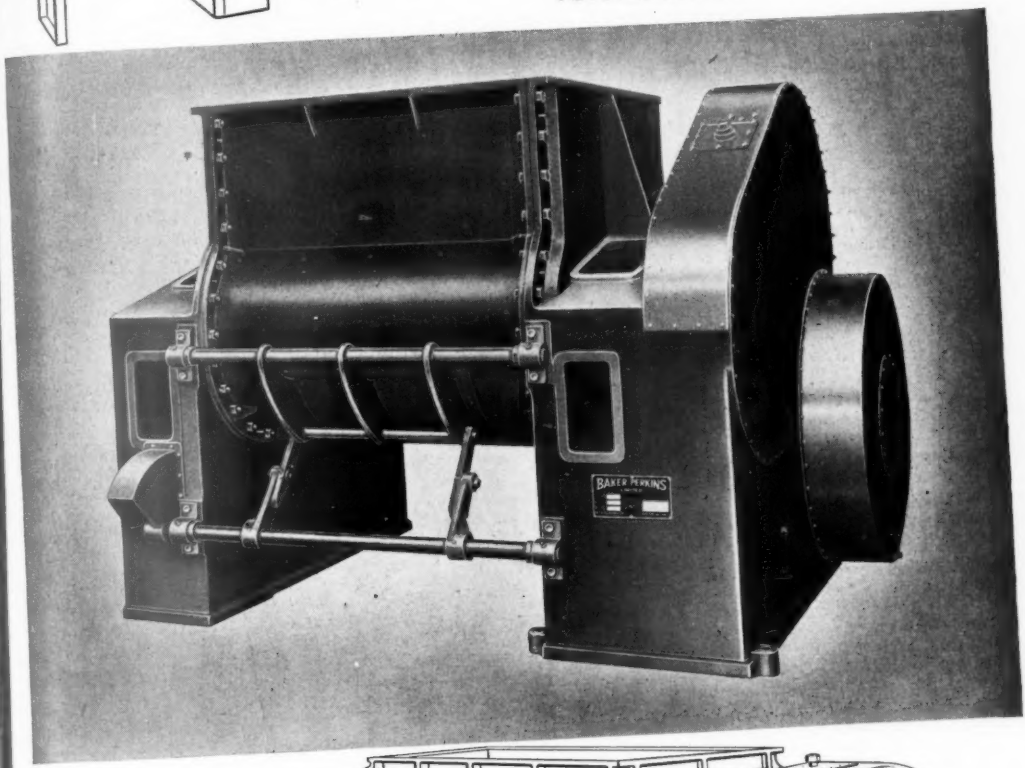
In addition to those acknowledged in the January 3 issue of the JOURNAL, Christmas cards, calendars and gifts have been received from the following: *Association Technique de Fonderie*; Chandra Foundries, Limited; Edward Everard, Limited; Institute of British Foundrymen, Australian branch (Victoria); F. Perkins, Limited; John Vickers & Sons, Limited; Widnes Foundry & Engineering Company, Limited; L. A. Witham & Company; T. H. Weaver; G. Waddington & Son, Limited; Zinc Development Association.

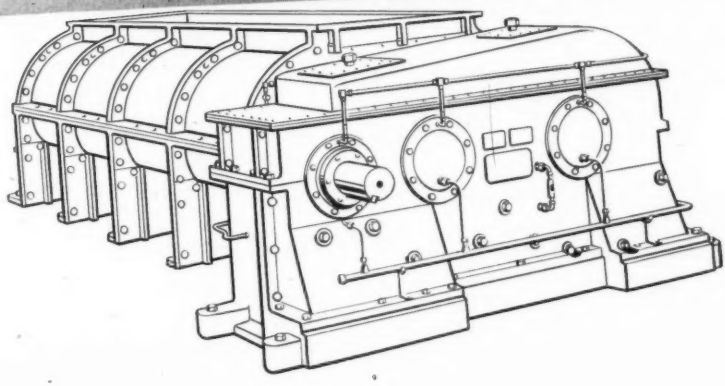
A NEW NORTHERN FACTORY INSPECTORATE DIVISION, comprising Cumberland, Durham, Northumberland, Westmorland, and the North Riding has been set up. HM Superintending Inspector is Mr. R. H. Thompson, with offices at Newcastle-upon-Tyne. Under the reorganization, Easingwold and Flaxton rural districts will be transferred from Leeds South district to Darlington district; and Scarborough, Malton, Pickering and Scalby, Helmsley, Kirby and Moorside districts will be transferred from Leeds South to the Middlesbrough district.



Batch and Continuous Sand Mixers

by BAKER PERKINS Ltd WESTWOOD WORKS PETERBOROUGH





✳ ENQUIRIES should be addressed to The Foundry Sales Dept.

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

January 16, 1957

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £20 1s. 0d.; Birmingham, £19 13s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £21 18s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £22 2s. 3d.

Scotch Iron.—No. 3 foundry, £23 4s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £24 6s. 6d.; South Zone, £24 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £25 14s. 0d.; South Zone, £25 16s. 6d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent. :—N.-E. of England (local iron), £22 17s. 6d.; Scotland (Scotch iron), Zone S. 1, £23 4s. 0d.; Sheffield, £24 4s. 6d.; Birmingham, £24 12s. 0d.; Wales (Welsh iron), £22 17s. 6d.

Basic Pig-iron.—£19 3s. 0d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £50 0s. 0d. to £51 15s. 0d., scale 17s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £70 0s. 0d. to £75 7s. 6d., scale 17s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 28s. 6d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 12s. 3d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £250 0s. 0d.; 38/40 per cent., £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 15s. 1d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 18s. 1d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C, £96 0s.0d. to £96 10s. 0d., basis 60 per cent. Cr, scale 33s. 0d. to 31s. 0d. per unit; over 6 per cent. C, £94 0s. 0d. to £95 10s. 0d., basis 60 per cent. Cr, scale 31s. 0d. per unit; 2 per cent. C,* 2s. 1½d. per lb. Cr; 1 per cent. C,* 2s. 2d. per lb. Cr; 0.15 per cent. C,* 2s. 2½d. per lb. Cr; 0.10 per cent. C,* 2s. 2¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 0d. to 7s. 6d. per lb.

Metallic Manganese.—90/92 per cent., carbon-free, £290 0s. 0d.; 96/98 per cent., £310 0s. 0d.

Ferro-columbium.—65/75 per cent.; Nb + Ta, 22s. 6d. to 23s. 6d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £75 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £30 9s. 0d.; tested, 0.08 to 0.25 per cent. C, £31 9s. 0d.; hard (0.41 to 0.60 per cent. C), £32 10s. 6d.; silico-manganese, £41 0s. 0d.; free-cutting, £34 13s. 0d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £38 4s. 6d., silico-manganese, £41 7s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £36 3s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £37 6s. 0d.; acid, up to 0.25 per cent. C, £40 7s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £39 2s. 0d.; boiler plates (N.-E. Coast), £41 12s. 0d.; floor plates (N.-E. Coast), £40 11s. 0d.; sectional material, N.-E. Coast, £37 11s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested (4-ton lots), £37 18s. 0d.; flats, 5 in. wide and under (4-ton lots), £37 18s. 0d.; hoop and strip, £37 17s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g, £41 6s. 0d.; black sheets (hand mill), 17/20 g., £52 4s. 0d.; galvanized corrugated sheets, 24 g., £65 9s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £64 13s. 9d.; nickel-chrome, £88 15s. 3d.; nickel-chrome-molybdenum, £100 13s. 9d.

NON-FERROUS METALS

Copper.—Cash, £269 10s. 0d. to £270 0s. 0d.; three months, £268 0s. 0d. to £268 10s. 0d.; settlement, £270 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 7½d. per lb. rods, 307s. 0d. per cwt. basis; 20 s.w.g., 340s. 3d. per cwt.

Tin.—Cash, £790 0s. 0d. to £792 0s. 0d.; three months, £776 0s. 0d. to £776 0s. 0d.; settlement, £792 0s. 0d.

Lead (Refined Pig).—Second half January, £116 10s. 0d. to £116 15s. 0d.; second half April, £114 10s. 0d. to £115 0s. 0d.

Zinc.—Second half January, £103 0s. 0d. to £103 10s. 0d.; second half April, £98 10s. 0d. to £98 15s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £134 10s. 0d.; rolled zinc (boiler plates), all English destinations, £132 5s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £110.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 2½d. per lb.; rods, drawn, 3s. 0¾d.; sheets to 10 w.g., 230s. 9d. per cwt.; wire, 2s. 10¾d.; rolled metal, 230s. 9d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £202; B6 (85/15), —; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £255; HTB2 (38 tons), —; HTB3 (48 tons), £263.

Gunmetal.—BS1400, LG2 (85/5/5/5), £275; LG3 (86/7/5/2), £285; G1 (88/10/2/½), £339; (88/10/2/1), £327.

Phosphor Bronze.—BS1400, PB1 (AID released), £351 per ton.

Phosphor Bronze Strip, etc.—Strip, 323s. 9d. per cwt.; sheets to 10 w.g., 323s. 9d. per cwt.; wire, 4s. 3½d. per lb.; rods, 3s. 7½d.; tubes, 3s. 5¾d.; chill cast bars: solids 3s. 7½d., cored 3s. 8½d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 4s. 0½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 5½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 4½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £84 10s. 0d. to £84 15s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £197 0s. 0d.; aluminium bronze (BS1400), AB1, £279; AB2, —. Solder, brazing, BS1945, type 3 (50/50), 3s. 1d. per lb., type 9 (54/46), 3s. 4½d. per lb.

* Average 68-70 per cent.